The Scientific Articulation of the Human Teeth as Founded on Geometrical, Mathematical and Mechanical Laws.

The Anatomical Articulator.

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For the third time I here revise all that I have said and done upon this most important of all my life's works and discoveries and upon which I am willing to die, feeling assured that it was as pure a revelation and inspiration to me as the laws of motion were to Kepler and the further continuation of those laws in establishing gravitation by Newton.

Forty years' elucidation, study and practical application every day has but convinced me that I can rest assured this work can never be blotted from the world's records. It is not at all strange that but few should have seen it as I have; but as for me, I see the crowning work of a great Creator who could design and construct such a marvelous and yet simple piece of mechanism.

The only mystery to me is that I, a poor uneducated man without any knowledge of geometry, should have been permitted to work out such a problem at the middle of the 19th century, when there was no precedent upon which I could found a single fact as a starting point. It is not an invention, but a simple and complete reproduction of the mechanism of the human jaws; and as I have said, it was the only thing I ever stole of a mechanical nature, and that was from the Divinity, or first originator of it.

While I almost despair of so placing it and the laws regulating it that all men can see and practically apply it as I do, yet I have some comfort when I recall the beautiful and philosophic language of Kepler when he had worked out and proven beyond doubt the laws of motion. He

knew from all previous history that it would be many years before others could mathematically see it as it was revealed to him. He said, "God has waited 6,000 years to reveal this to me, I can afford to wait a century to have others receive it." It is long that I have waited and labored for its full recognition, although but few have practically used it in the high art of Dentistry.

How few would have labored, as I did for twenty-eight years, to place on paper the diagrams seen in this article? The working model was completed in one day; the drawings to elucidate the laws by which others could see the workings of a supreme Creator shown through the intellect of man, has been the work of long years of application against prejudice and frowns.

Is it any wonder then when done and I was viewing, soon after, that grand structure by human hands—the Cologne Cathedral—and while flat on my back looking up at the beautiful architecture that I should have contrasted man's work with what I said when I had completed those drawings of majestic mechanism and art, the human teeth, "This is God's architecture!" While yet in wonder and admiration, before I quit that building, I was, by inspiration, made to pen, while still on my back, these verses:

In this alone no grander work can be,
Intelligence reigns supreme!
The highest concept all must come to see
And over all a Conscious Deity.

None can doubt when once the study's made
These pearls reveal the Majesty of Power,
Their curves and angles in Geometry were laid,
Above man's genius ever they must tower.

Their vaulted arches could have ne'er been perched
Upon those fluted columns in their princely height,
Without a Master who had Creation searched,
And plan'd a model in itself full right.

The curves, the angles, arches all,
From base to dome, but one reply must give;
Nature nor man could not from nothing call
A model so unique that could forever live.

Then I cannot reproach my fellows with having been so slow in adopting what has been revealed to me of the absolute workings of mechanical and geometrical laws.

This revision then I do with pleasure, seeing as I do that the day dawns and men are awake to the light of forty years from some central sun before it had reached their elementary globe.

Why the Diagrams Should be Studied.

I am asked by all, "Is it necessary that I know all these drawings, and your laws in order to use your articulator, without which you tell us no artificial teeth can be properly mounted?" No! my boys, yet it is well to master them for the cutlture in their study and in the love you will afterward have in the practice of our highest of arts and mechanisms, and it will not have been work in vain. You will feel prouder of yourself and your noble profession and you perhaps feel grateful to a man who has been the medium in it of such a unique discovery. Yes, it will show you that these laws underlie the whole of our work from the proper contouring of our fillings to keep up normal articulation and occlusion and how careful we should be how we touch or destroy the approximal surfaces without knowing how again to restore them.

In knowing the *normal* jaws, you will then see the deviations to *abnormality*. You will then understand me when I tell you I treat *pyorrhea* with it, and best of all why I never have that disease in my regular practice when I have had full charge from childhood.

It will enable you to see from this perfect articulation which you can only know when you have ground on a full set of plain artificial teeth, that the study of these laws will enlighten you in the true science of correcting irregularities. When plaster casts are made of both jaws and placed in this articulator you will see as you never did before how ignorant you had been and how criminal in your treatment in such cases.

It sheds a new light upon every pathway of your practice. So much radiance does it give, you will ponder well before you dare to place an all gold crown or a permanent bridge, for you will realize your responsibility in mutilating human teeth, and of how little value your productions in this line have been as masticators, and you will know *when* a *tooth* or *teeth should be lost for health.*

Then do not neglect to study the laws and dentistry will assume new proportions as you advance. You must understand that all the drawings showing the width of teeth in nature are made from the lower jaw always. The upper are shown to be in harmony with the mobile part by the same law of the equilateral triangle and all these are shown absolutely true from no other assistance than the dividers and the law, and there is no guesswork about it. There is shown to be a correspondence, relationship and harmony that reveals no missing link in the whole chain of demonstrations.

Reply to Dr. W. E. Walker's Criticisms.

In all these years but one man has dared to tell me I was wrong and that all the prosthetic work I had made was a staring, grinning evidence against me, Dr. W. Ernest Walker, of Pass Christian, Miss., who had found out also that I was not the inventor of the articulator. "It was done in 1887 by a Southern gentleman," he said.

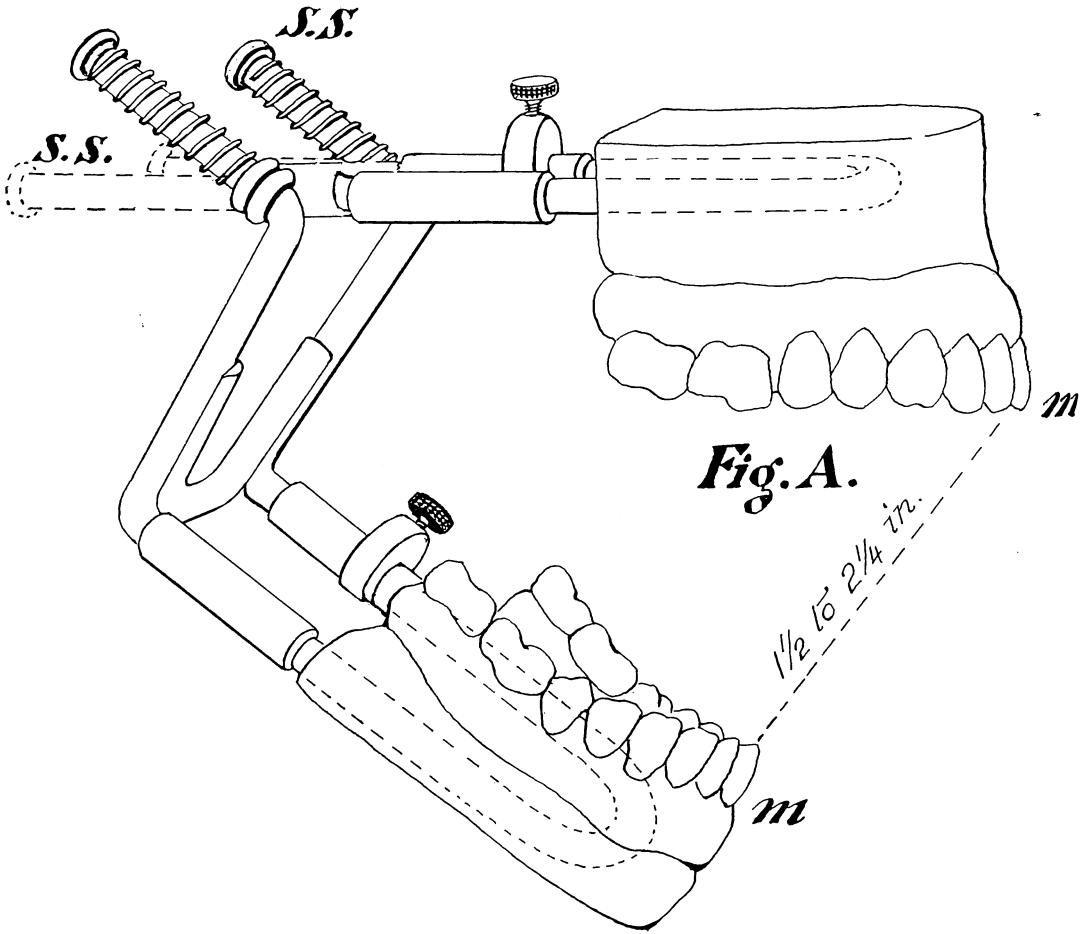


Fig. A.

I am mortal; but, when it comes to mechanics and geometry, their laws and demonstrations, I think there is some little due me for what I have done in this line. I am willing to be convinced of any error, but not by one who does not know as yet how to articulate a set of teeth in his perfect articulator! I would have my young critic come and take a first

elementary lesson from me, and I would show him that it was not at all wonderful that he should have said that my instrument does not give the dip downwards and forwards at the Glenoid fossa. Like every one who takes up my articulator with a set of ground-up teeth in it, with the left hand, he took hold of the lower jaw and moved the upper jaw to see if the articulation was correct. When this is done, all critics have a perfect right to say "Bonwill is wrong."

Let me now for the first time tell my critics that if they would know the truth, without sectional prejudice, let them grasp the *upper cast* in the Bonwill articulator and *move the lower,* and they will soon see that the dip down and forward at the Glenoid fossa agrees exactly with the depth of the overbite (Fig. A).

The greatest overbite is one-eighth of an inch normal, and if they will watch the short arm of the articulator, around which are the spiral springs, they will rise as the lower jaw drops down and allow the proper dip downwards and forwards and no more or less. The depth of the overbite at the incisors controls the depths of the grooves or fissure between all the bicuspid and molar cusps. This is true in nature and the Glenoid fossa is ever changing, from the temporary teeth on to meet the law which controls the human jaw, and this change is undergone as the natural teeth are lost. It is this change that has interfered in the production of successful cases of artificial dentures when using other articulators. To me, the shapes of the fossæ are immaterial, for they are never the same angle on either side, but as soon as the artificial set is placed in as I make them, no matter what may be the angle at the fossa from previous use and maluse, they conform to my laws and demonstrations. If the artificial teeth are placed on by having the incisors come into direct contact instead of an overbite, then all the teeth will have to be perfectly flat on their cutting and articulating surfaces and it will be found that those short arms, on the articulator, with the spiral springs around them, will stand perfectly still and not move a hair's breadth. There being no overbite the teeth swing around without any inpediment. To hold the lower cast in the articulator and move the upper, which every one does, will not show the movement at the fossa. It is the reverse, and, to fully get the lateral and forward action of the lower jaw, the articulator must be held with the incisor teeth, not towards you but from you.

Philosophy of Mastication.

You will now realize when held in this position the mechanism of mastication, and that only one side can be utilized in the motion of lower jaw at one time.

To obtain all the surfaces for mastication on the left side, the bolus of food is thrown by the tongue to that side and between the cheek and teeth and, when the lower jaw is

thrown to the left, all the surfaces that is possible of the teeth, from the central incisors to the second molar on that side present the greatest proportion of articulating surfaces, and in the carrying out of the lower jaw to the right for action, the left side in the upper is cutting on its buccal side and crushing on the palatal; and in the lower set the lingual are cutting and the buccal crushing. It will be observed at once that, on the right side when the lower jaw is carried to the left to grind the food on that side, only one half the surface is touching, and if the food could be kept on that side now while in that position it would be kept always between the cheek and the teeth and never be comminuted.

It is the simple mechanical law as applied by man when he made the first pair of millstones *which he created,* as there was nothing in nature he could have seen to give him the idea. When a pair of millstones are grooved to the left from the centre of the stone and the upper stone is revolved to the right, then the grist when thrown into the central opening of the upper stone, is gradually ground and carried to the periphery of the stones where it is being constantly cleared from between the stones. But, if the upper stone is revolved to the left with the grooves unaltered, the grain would remain in the central opening of the upper stone and choke, and could never get between the stones. The elephant's teeth are grooved to perform just this beautiful, wonderful piece of work which could have been done in no other way by either God, nature, evolution or man. It is mechanical law, and that of motion, to obtain a certain result for the perpetuation of the organs themselves, but the life of the whole organization and the grooves, fissures, cusps are so arranged by this same intelligent designer and master workman that where each are in their normal position in the jaws all surfaces wear alike and the shapes are kept in harmony.

After more than forty-five years of active life in dentistry, I am fully persuaded that of all that constitutes dentistry proper, the mechanical forms the basis. And yet, to make anything that is beautiful in our art, especially in vieing with Nature in matching the teeth, we must be more than mere mechanics, more than capable of filling a tooth or treating an abscess; we must be dental artists. When we come to place in a set of teeth upon which depends so largely the expression of the face from the soul beneath, we must bring to our aid, not only the laws of mechanics and geometry, but the beauties of art. It is not enough that we accurately adapt the plate to the gums; that we so grind the teeth to the plate as to be water-tight; that we so make every joint that it cannot be distinguished; that we so polish the plate over symmetrical curves, that the tongue cannot find the least fault; we must do something besides this, we must impart action to these otherwise whited sepulchres; we must instil

life therein, or our labor will be in vain. A tooth may be elegantly shaped and colored, yet if it lacks the proper shape for the person for whom it is intended and is unskilfully set in the arch, it is a failure. The blocks from the same mould set by different operators, may vary in effects in every case. To get proper effects you should have a number of plain teeth of the various shapes, colors and sizes, and try them under the lips until your judgment tells you which to use. Your taste can be so cultivated that you will be apt to criticise your own selections.

I shall use the term articulation instead of occlusion, for the very good reason that it is more in keeping with the functions or the motions of the jaw. If there was but one movement to the lower jaw, and that up and down, we might possibly say occlusion. But this latter term applies more properly to shutting the lips or closing the mouth, and not to the motion of the lower jaw dependent on the articulation of the same at the Glenoid cavity, where the articulation is universal. Articulation is a word of action throughout, while occlusion answers to the mere act of closing the teeth and lips and keeping them closed; one is active the other passive. Before we can comprehend then what constitutes true articulation of artificial teeth, we must look at the anatomy of the human jaw and its functions.

Anatomy of the Human Jaw.

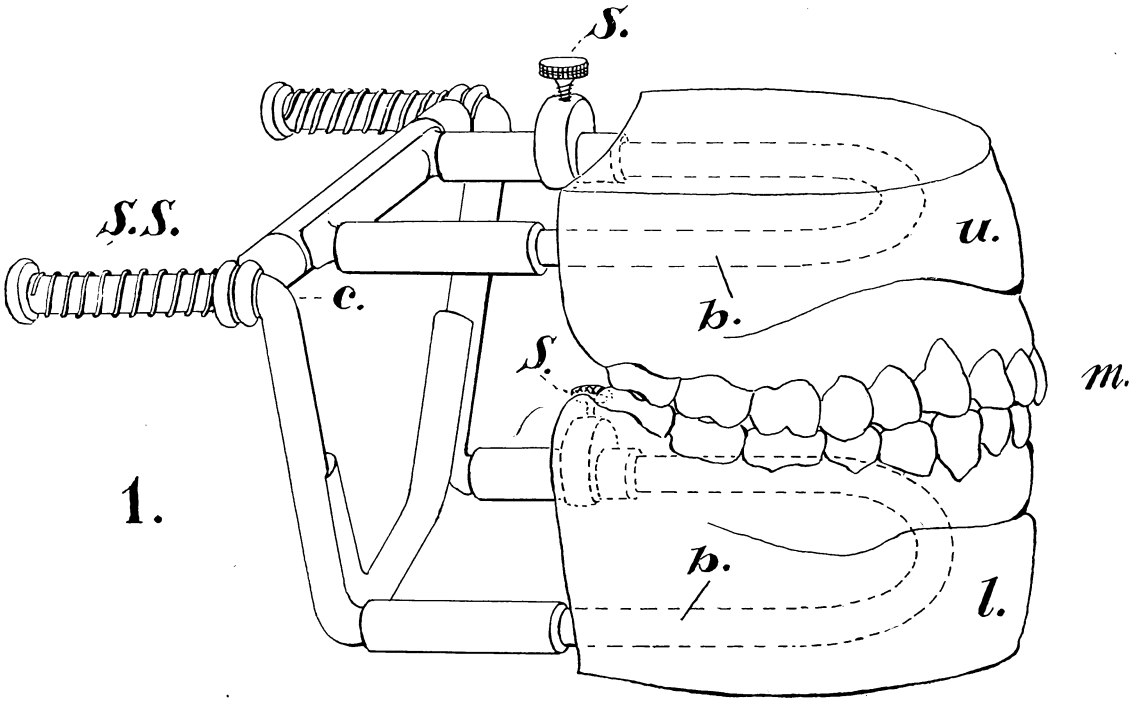
We find from 28 to 32 teeth in each jaw, arranged in such manner that no two strike directly against each other, but antagonizing in such a manner as to prevent the whole denture from becoming very irregular, which would be the case if striking one against another. By this arrangement, when one tooth is lost, the regularity of the arch is not interfered with. As necessary as this is in nature, it is not positively necessary to follow it in prosthetic work, although for the sake of harmony it should be done.

It will be found in 95 per cent of cases that the upper teeth project over the lower, and the depth of overbite varies as the depth of the cusps of the bicuspids are deep or shallow; and the ramus will be found to come upward and backward in relative proportion to the length of the cusps and the overbite.

One point of very great importance has not been discovered in general or special anatomy—the peculiar *tripod arrangement of the lower jaw forming an equilateral triangle.*

From the centre of one condyloid process to the other, four inches is about the average; and it will be found that from this same centre of the condyloid process to the median line at the point where the inferior centrals touch at the cutting edge, is also four inches. It is strange it should have been overlooked; but it only shows, when studied in a geometrical and

mechanical sense, the great wisdom in our formation. It varies slightly, but never more than one-fourth of an inch, which would make but a trifling difference in describing the arc of a circle. You will perceive that, in setting your artificial teeth a one-fourth inch in the radius of the circle of four inches would not materially alter the articulation. Without such an arrangement the teeth would have to be flat on their grinding surfaces to admit of lateral movement. Besides, you would not have the beautiful and wise curvature at the ramus, for equalizing the force applied to the teeth in all directions.



Imagine the human jaw jointed at the pharynx, or as you see in the ordinary brass articulators. Do you suppose that there would be any greater wisdom displayed in such hinging or articulating a part destined to such varying motions and powerful wrenching force? No! The study of this one part of the head and jaws shows one of the most striking designs of a Great First Cause; and, when studied, you will see that every part of our frame is made by a positive law and to subserve definite purposes; such law being in consonance with geometry and physics and mechanics. We must see the true use or function of the jaw and the teeth, and the food destined for us, and how it should be comminuted; there is no

chance work about it! There is law and order pervading every part; the jaw forms a perfect triangle, for the purpose of bringing into contact the largest proportion of grinding surface of the bicuspids and molars, and, at the same time to have the incisors all come into action during these lateral movements.

You will also find that from the cuspids, the bicuspids and molars run in nearly a straight line instead of a curved one, back towards the condyloid process, enabling them to keep the largest proportion of surface always presented for mastication. Another thing which has never been explained by anatomists or naturalists, is the law of the normal relation of the upper to the lower incisors. The normal jaw should overjet and also have a corresponding underbite. Without such a law the incisors would lose largely their functions, that of incising on the principle of a pair of scissors. Where incisors strike directly upon each other, the power to

FIG. 2.

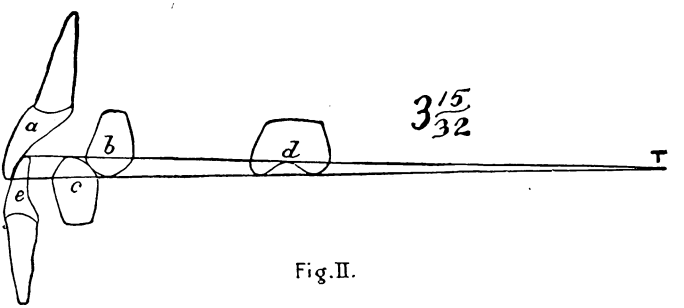


Fig. II.

cut off food is very much lessened. The length of the cusps of bicuspids and molars proves the law.

Another unobserved fact where law is expressed, where there is an overbite and underbite, just in proportion to their depth will be the length of the cusps of the cuspids, bicuspids and molars. By drawing two lines from T to a and e, Fig. 2, we have the length of the cusps of the bicuspids, b, in the upper, and c in the lower, and also, the second upper molar. The depth of the underbite is one-eighth of an inch from the cutting edge of the lower central incisor e to that of the upper central incisor a. Did the teeth extend as far back as T there would be flat surfaces at those points. But in articulating artificial teeth, when the upper second molar is reached, its distal cusp has to be raised from line T e to T a, Fig. 2, to allow molar teeth on the opposite side, not in mastication, to touch, for merely balancing the plate, as Fig. 5, M, N, otherwise the second molars would be of no use in lateral movement, nor would the first molars. This curvature at the ramus (see Fig. 7) commences at the first molar, although it shows

itself slightly in the bicuspids. Practically, it need commence at the first upper molar. This curve, then, will always be proportioned by the underbite at a, e. The length of the cusps on bicuspids will never be more than an eighth of an inch, normally; the groove deeper than that would cut the palatal cusp off, and make of it a cuspid. It would in reality be cut in twain. *This is another unobserved fact. It always has been and will be found in the archtype of human jaws.* So that when you see a first upper bicuspid, it can very well be told from the length of the cusps whether the

FIG. 3.

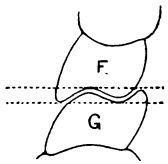


Fig. III.

FIG. 4.

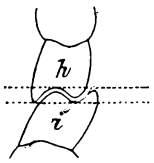


Fig. IV.

jaw from which it came had a depth of underbite of one-sixteenth of an inch or more. Where the teeth all strike fairly one upon the other and no overbite, then you have no occasion for cusps. If originally there, they would soon be worn off from the abnormal articulation.

This provision of articulation is most wise, carrying out still more fully the exact law by which the anatomical movements of the lower jaw for perfect mastication are governed. So beautiful and so mathematical a design cannot but call forth our admiration and wonder; and the study of

FIG. 5.

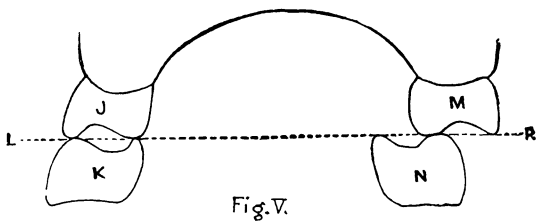


Fig. V.

no other part of the human body will give one a clearer idea of infinite wisdom. This movement we will find, in the artificial sets arranged upon this law, will prevent the plate from tilting. In the natural denture the incisors are really the first teeth to be arranged; though the first molars emerge first, to assist in the more perfect mastication of food and to keep the jaws at the proper distance. The incisors show a definite fixedness of purpose to arrange themselves after their typal shape, and to form the overjet and overbite at a given depth, for the accommodation of the bicuspids and molars which are soon to appear, having cusps of a definite

length, so that the law of articulation which has been premeditated to a certain typal shape and construction may be carried out.

It will also be found that the grinding surfaces of the bicuspids and molars have a typal shape—allowing them to meet with all their surfaces touching—for an express purpose, after a preordained and established law, from which the greatest area is gained for mastication; and that the lingual cusps of the lower teeth are as necessary as the buccal of the upper, when laterally moved. The law is still further carried out in the curvature at

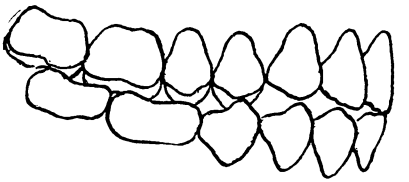


Fig. VI

the ramus, from the second bicuspid to the third molar, to permit all the surfaces on one side to be in contact (Fig. 7), while the other unused side is only partially so (Fig. 6). The nearly straight line of arrangement from the cuspids to the last molar is also in keeping with the underbite (Fig. 7). It may well be asked just here: "Will this law hold good in an artificial articulator such as I use, applied to setting of artificial teeth?" As soon as you once attempt to apply this principle you must certainly grasp this law, so wise and beautiful. There may be variations, but the

FIG. 7.

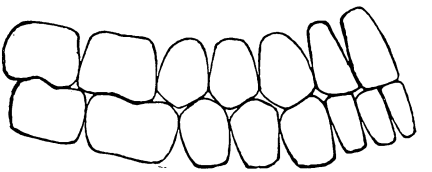


Fig. VII.

general law will hold good, and where there has been much latitude or varying from it by abnormal mixtures of races or types, if Nature is given a fair chance to right herself, she will return to the normal standard of mathematical and mechanical precision; to do otherwise would annihilate creation. *Cells free to arrange themselves must develop the original creation, and perpetuate and keep it to the perfect standard, by selecting the highest type of perfection in shape, strength, beauty, etc.*

The query here naturally arises to those who have never looked into the philosophy of this matter, whether these peculiarities are necessary, and if it is possible to utilize them in our artificial dentures; and, if so, how can

it be done by any of the articulators now in the market, or can it be done at all by any human device? To all these inquiries I answer in the affirmative.

As to the necessity, it should need no argument to convince you that an artificial denture should correspond to the natural one in every respect as nearly as can be approached. It may be a question with you how nearly art and mechanics can imitate the natural movements and expressions. Has there ever been any rule heretofore given by which you can regulate your beginning and ending with any kind of design? Have you any chart, system or plan to go upon, such as the plot or sketches by which architect, artist or sculptor can bring forth his ideal? No! I say most emphatically. Look at all the sets of teeth made, I care not from whose hands they come, and you will not find one made after any special law to suit the individual case. Not that no sets have ever been made that have not been serviceable or looked well, or where no taste has been manifested; I have seen many, but how much more useful and lifelike they can be made by following the system as found in the natural jaw. It is strange that these points should have been overlooked so long. To have examined the human jaw critically would have led to the plan at once. But we have acted on the principle that artificial teeth can only admit of the up and down or hingelike movement. To allow of the lateral motion is thought to be impractical, as it would throw or upset them, and render them difficult to keep in place. The regular horseshoe shape has been adhered to up to the present, for fear that if the molars were placed outside the arch, the plate would tilt, and mastication be impossible. To give to the teeth the greatest advantage, you are taught by some to let the cutting edges of the incisors meet squarely, and have no overbite. If there has to be overbite, then the arch must be large and wide, more than normal.

It is taught that it is vandalism to grind the antagonizing surfaces of teeth, as if there was but one magnate to see them, the manufacturer of the teeth. You are also taught that but one side or cusp of the bicuspids and molars can be made to antagonize. As I have studied the matter in its manifold bearings, and as my forte is mechanics, I speak as having authority; and, if practice is of any value in establishing theory, I am prepared to give it to you in various ways, and attest that the adaptation of such work in the mouth holds good to the law as it does in my articulator. So that when you have fitted in this device on the law laid down here, a set of teeth for any jaw, you can rely upon it, that if you had the jaw itself in your hands, you could not approach more nearly to what is demanded. In some cases there is need of touching a cusp here and there, but to a very trifling extent.

This triangle can only be found within a perfect circle in which you

have the greatest breadth and area of surface. No other geometrical angle would have given such perfect beauty and symmetry to the face. The compactness brings the largest number of teeth nearest the centre of motion. The double joints permits the greatest strength and the easiest lateral movement with the greatest range of this at the least expense of power and compass. It permits the largest number of teeth to antagonize at every movement, *and, not least of all, this very triangle is the means by which nature develops the typal shape of the ramus, and of the formation of the jaws, the underbite and controls the Glenoid fossa.*

It will be observed, that in making the natural movement of the lower jaw to the left, the condyle of the left side stands still or does not move

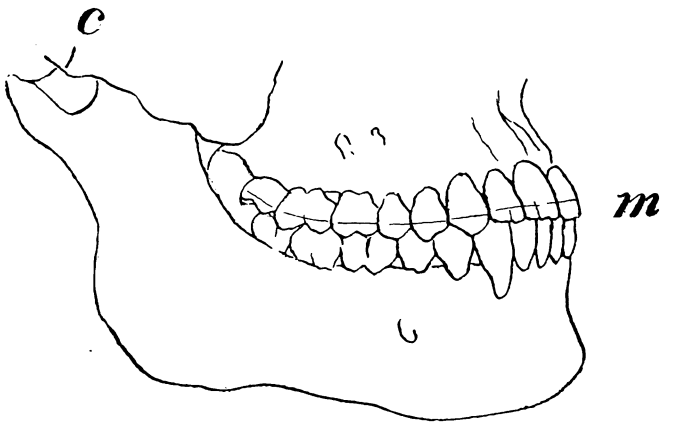


Fig. 8.

forward, it merely revolves or rotates in the socket, which is but a trifle. The right condyle moves forward and downward in the Glenoid cavity one-eighth of an inch, when at its farthest limit, causing the outer cusps of the upper, from the centrals to the last molar, to touch the outer and inner or buccal and lingual cusps of the lower on same side—the left (Fig. 8 and J K, Fig. 5) ; and on the opposite side (Fig. 6, and M. N, Fig. 5)—the right—we find only the inner cusps of the bicuspids and molars of the upper, to come in contact with the outer of the lower, and the right central to the cuspid do not touch. And why so little surface touching on right side when the lower jaw is thrown to the left? You cannot masticate on more than one side at once, and when you throw the jaw to the left in the act of masticating, the food is upon that side, hence there is no necessity for the right side to have so much surface in contact. But why should

it touch at all on the right? In order that the muscles on both sides should act equally, which could not be done if the teeth were not allowed to strike there, giving support to that side of the jaw, and equalizing the force brought to bear upon that side, although no food be there. If there were no touching of the teeth on that side while mastication is going on upon the left side, there would result, as a sequence, that peculiar movement of the lower jaw at the condyloid process, which makes it difficult to place in teeth for the aged or those even in early life, who have lost all the grinders on one side.

The form of triangle is necessary again for the purpose of giving the largest number of muscles a chance to act on both sides simultaneously and concentratedly, thereby keeping the circle or arch of grinders down to their work and equalizing the pressure on all sides. It enables the teeth on the side where the chewing is being done to arrange themselves when erupting, so that they will be very nearly in a line with the left condyle, which is now passive on this side, and forms one point of the dividers in forming the arc of a circle; and by this condyle being where it is—four inches from the other—the molars and bicuspids, as well as the central of that side, all come into the most perfect contact, for chewing and incising, thereby carrying out this absolute natural law of the perfect adaptation of geometry and mechanics to her uses, and having no lost motion or function in any part.

Again, the triangle gives us an extra motion forward, which brings the lower teeth in contact with the upper to incise or cut off food presented there. This could not have been with any other arrangement than the triangle. One central point at the pharynx or on the median line would have been a single swivel joint, and have brought the teeth across each other in such a way that as soon as any lateral movement commenced, they would be drawn away from each other very rapidly, and but little surface be in contact. This triangle will enable you to get just the exact depth of underbite from the incisors to the last molar, and the exact shape of arches; and particularly that of the ramus, which is not a matter of chance—neither is the length of cusps on the bicuspids and molars mere chance. The type has been preordained, just as the nose on your face, or the peculiar shape of the eye, or any other one part of the body. And you will find that where a superior bicuspid has a cusp of a given length, the overbite will be governed and ruled by it. It cannot be otherwise. If in the arrangement of the teeth in the human jaw, no type or design were laid down in conception or embryonic life, what malformed creatures we should be, mentally and physically! *And it will be found that just in proportion as there is congenital insanity, or want of will or directing power, there will be a malformation of the teeth and their arrangement.*

The next step is, now that we know the exact shape of the jaw and its philosophy of form and functions, we must have at our command something *so nearly approaching it,* that we can place our models upon it, and thus again restore nature's "lost art."

The Bonwill Articulator Described.

I believe I have it so near that it will be found to answer our most fastidious notions of setting teeth on plates by a system. The instrument is made of brass wire one-eighth of an inch in diameter (Fig. 1), *and of such shape and movements as to correspond exactly with the mechanism of the human jaws.* The base with its movements forms one part, and the two bows another. But one base is necessary for any number of cases. The bows which are separable from the base, can be duplicated to any number. They are held firmly by thumb-screws, and after a case is once articulated to the bows, they can be laid aside for future use. The lateral motion forbids the use of a prop to keep the bows apart. At first sight it would seem that the lower bow is moving in the wrong direction. Its motions are precise and correct. This has never been changed in design since first invented, in 1858. It permits of seeing whether the palatal and lingual cusps properly touch. In using it to get the lateral movement, one condyle must be kept close to the point where it is held by the spiral spring, while the opposite one moves forward. Never use both springs at once, except in bringing the lower jaw forward for incising. This method demonstrates that there is but one way to make a set of teeth articulate.

Method of Using the Articulator.

Before placing the wax models in the articulator, it will not be out of place to say a word about this arrangement of the wax on the base plate, and the selection of teeth in full sets. Always model the upper wax first, judging of the length of incisors by the trial of an artificial tooth in the mouth, such as, in shape, length and width, would look natural and appropriate, when held under the lip. This will enable you to get the height of wax and the contour after successive trial. The modeling of the wax on the upper plate is not arbitrary or fixed, so far as a definite law is concerned, in being able to work after a set pattern; here the true dental artist comes in. You get the length by trial of several blocks or single gum or plain teeth, as may be, as well as shade of same. As to the arch of upper you must add to and take from, making depressions, etc., until your judgment tells you it is correct. To aid amazingly in this work of art, draw out the patient in a smile or broad convulsive laugh; compel him to do so; nothing tends so to relax most universally every muscle and give true expression to the countenance. If the wax is not in keeping with symmetry you will see where the trouble lies. Look at

them in front and on either side when they are laughing as a sculptor would upon his model. Be sure that the arch at the cuspids that form a double keystone to the arch stand out more prominently than any others. The superior first bicuspid should nearly always fall back somewhat behind the cuspids.

Now that the upper wax is correct, the same rule applies to the lower. It is easy to make this conform to the upper; you may have to change the upper in some respects when tried with the lower, but not much. The length of wax at the molars may have to be trimmed to allow of equalizing the length of the teeth on upper and lower plates. Laughing and smiling will here again tell. Be sure to mark the centre at the median line, making marks or grooves through on either side, running from upper to lower for guide; they can be removed and are now ready for the articulator, with their bows pushed into their sockets in the base, which are retained by thumbscrews. The plaster models or casts with the wax articulation or bite thereon—and all fastened together by wax or cement to prevent being displaced from the cast—are now placed on the lower bow of the articulator, and the upper bow brought over upon the upper cast. Your eye soon detects whether the median line on wax is in the centre. To get the cast in proper place, have a pair of dividers four inches between points, and by it place the cast in position, with centre of lower teeth at the median line just four inches from the condyles on either side. Hold in position, while with plaster you secure the upper to the bow, and when hard, the lower bow to the plaster cast in the same way.

It may be asked where is the set screw to hold open the jaws of the articulator after wax is taken off? I have never found it necessary in this kind of frame. Before taking off the wax, I take a pair of dividers, or a piece of wire bent with the points about one inch and a half apart, and mark, with one foot on plaster cast, and the other at cutting edge of wax, the bite at the median line. Do this for both jaws. To secure this height mark on each cast with the dividers, the distance apart or width of dividers, and this will always be your guide for height. Take off all the upper wax—except a section at the molars—first, and let the lower remain as a guide, for the arch of the upper. The first block or tooth fitted on the upper when backed with wax, answers perfectly to keep the jaws of the articulator apart. The set screw would be in the way with the lateral movements. I stated that the length or depth of underbite in full sets, is restricted to the width of the jaws and length of the centrals, which it is presumed have been selected to suit the individual case. Knowing how much the underbite is to be, you can very nearly guess how much to cut out the bicuspids and molars on all the grinding surfaces, *before any of them are fastened to the base plate*, and how much arch at the ramus, from

the second bicuspid backward and upward. If the underbite at the centrals is to be an eighth of an inch, then the bicuspids in the upper will have grooves between the cusps not quite so deep, and the molars still less. From the cuspids, then, the cusps are less to the second molar; were the incisors to strike equally and directly on each other, there could be no cusps or they would be of no use. The inner cusps of the upper should, as a general rule, be longer or higher than the outer. (See Figs. 3 and 5.) The outer cusp is more acute, the inner rounded. The lower the reverse—inner sharper and outer rounded, where the upper closes over the lower. For full sets you need but slight underbite and overbite, only enough to permit the lower to come forward and act as shears for cutting; at the same time it permits of cusps to both bicuspids and molars, and gives all double amount of grinding surface; there being cusps that touch on palatal and lingual sides, at same time as the buccal. Always bear in mind that the curvature upwards at the ramus, of the upper set, is in proportion to the underbite.

If for an upper set alone, you can tell how much the upper incisors should overbite, by looking at the curvature of lower molar teeth remaining. If an eighth of an inch out of line, the overbite should be fully so. This, when once understood, can give no trouble. The grooves in bicuspids and molars will form with the cusps, buccal and lingual, an ogee, as seen in Figs. 3 and 5, to give double the grinding surface when worked laterally; besides giving double cutting edges. *The first bicuspid in the lower jaw should have but one cusp.* This perfect design will be seen in the articulator why it should have but one. Two would not only be in the way of the tongue, but be of no use. Be sure that the groove in the upper is made nearer the buccal side, and for the lower or lingual side, for a reason which you will presently have explained, as seen in Fig. 3. Now that the grooves are completed in the upper and all the teeth in place in the arch, we will articulate the teeth on the lower base. The height is soon ascertained by the dividers, as well as the wax, and the central incisors tried on to see what changes will be needed. Fasten temporarily with wax, and try it with the lateral motion and the points adjusted to meet all the surface on palatal side of upper teeth, when the lower is thrown to the side of the tooth being fitted. Grind from the cutting surfaces of each, whichever will make the most natural and strongest case. If for a very young subject, be careful; but for a middle-aged or elderly person do not scruple about the cutting edge and grinding surfaces, but sacrifice even the labial or palatal surface, for the sake of effect and usefulness.

I sometimes turn the buccal side of a molar inward, to save substance and get effect and for better adjustment; frequently for want of room at ramus I do this; and, occasionally, turn buccal side upwards for the grind-

ing surface. If using blocks, before the front ones are fastened securely to the base plate, and while they are temporarily in their righ place, try the bicuspid blocks, to find out how much of the joint should come off of the incisors or the bicuspid block; or divide it. This will secure a better and more continuous joint, and give the lower better chance to be arranged to the upper. Before taking off too much of the joint of either of these blocks, try the lower incisor and bicuspid block temporarily on wax, to know where the cusps are going to come. Regulate the joints by this. *Never cut off any of the lingual cusps of the lower bicuspid and molar teeth*, such as are now made, as they are universally too short, and to get them long enough for service a large portion of the buccal cusps have to be cut down and rounded.

The palatal cusps of the upper strike between the outer and inner of the lower (see Fig. 3) and, at the same time, these cusps should be long enough to allow in the lateral movement, the incisors and cuspid on that same side to touch simultaneously, all the surface from the central to the last molar. If they do not, then your remedy is to make the groove deeper in both upper and lower, or perhaps the lower only, or the upper only (see J K, Fig. 5). Experience here will soon teach you which. When all the cusps are touching inner and outer and the front one, take the opposite bicuspid and do likewise; and with the additional precaution, when the lower jaw of the articulator is turned to the left, to make the inner cusps of the upper strike the upper cusps of the lower (M N, Fig. 5) and *vice versa,* when thrown to the lateral right or left (J K, Fig. 5). The molars must have the same rule applied, with yet another additional point of great importance.

The curvature of the ramus must be made to conform to the depth of overbite (see Figs. 6, 7 and 8), so that when the lower jaw is thrown to the right, the outer and inner cusps of both upper and lower sets on that side come together at the same time that the bicuspids and incisors do (see Fig. 7); but the curvature should be great enough to permit on the opposite side of the second molar tooth in the lower, which slides forward to meet the first molar in the upper, apparently moving backward (Fig. 6). If they were on a plane, they would never touch, on account of the jaws opening as they move laterally to the right or left; to mount up on the cusps of the incisors an eighth of an inch, which would not allow the molars to touch, if on a straight line backward. But inasmuch as on the plane of grinding surface the first upper molar stands higher in the upper plane, the sliding forward of the lower jaw in the glenoid cavity brings the higher second molar in the lower, in continuous contact with the first superior molar, as well as both outer and inner cusps of bicuspids and molars of the upper and lower jaw (Fig. 6). This is specially done to

equalize the pressure and force on both sides or parts of the dental arches. This permits of the most compensating arrangement of the teeth for equalizing the action of muscles on both sides simultaneously, and getting the greatest amount of grinding surface at each movement. This arrangement of bicuspids and molars is found in nearly all the lower animals; *the incisors, however, never touch when the jaws are in lateral movement.* Turn the lower jaw to either side and the effect is the same. *As I before said, but one side of the mouth can be used at the same instant, leaving the other free to balance the other side at work.*

If the upper arch of incisors *of the natural teeth* should be broad or deep on account of the thickness of the base or body of the incisors, or where they are much inclined to protrude, then the arch at the ramus is not so great. In artificial sets this need never occur, carrying out the same rule in nearly every case, of controlling the curvature at the ramus, by the depth of overbite and lengths of cusps of bicuspids. This system holds good in partial sets as well.

This is all that is necessary to be said on articulation proper; it remains only to give a few points having a bearing on the practical perfection of the same. Select the broadest grinding surfaces to bicuspids and molars, that the bolus of food may be held securely on their faces, taxing less the muscles of the face engaged in mastication. Narrow surface would rather tend to cut the food than grind it. This is of no mean importance in rendering artificial teeth of greatest use.

To produce the most natural effect the centrals should be the lightest in color, and the cuspids a shade or so darker, with a difference in color of all the back teeth. I prefer on this account to set plain teeth wherever admissible—and nearly all lower cases are so—and use different shades and arrange irregularly. The lower incisor teeth are mostly crowded, and I find to lap them over and distort them, even to a great extent, adds very greatly to their natural appearance. Do not be afraid of getting any case too irregular; very few natural sets can boast of perfect symmetry.

After the teeth are all ground on the plates they should always be tried in the mouth to see if they are perfectly correct before permanently fastening. As the mouth is more yielding in one part than another, the closing of the jaws rather firmly will allow of slight readjusting of themselves on the wax. If, when finished, they are found not to articulate properly—which is sometimes the case from the soldering or vulcanizing—have the patient bite on a strip of wax placed between the grinding surfaces to show the relation of each. Then put this back into the articulator and rearrange the grinding surface. It will be found to need but a trifling alteration.

The false movement of the lower jaw at the condyles is found in

nearly all persons who have had but one or two teeth remaining in the front arch, to reach which the jaw must be thrust forward and laterally; and when artificial ones are placed in, the same old movements are continued until their attention is called to it. It can be corrected without any special arrangement other than following the law herein laid down. The fossa will change to meet the teeth as arranged in this articulator.

(To be Continued.)

Significance of the Equilateral Triangle.

Plato placed this angle as the most important of all geometrical work; and as a purely scientific mind, he ignored all men as unscientific unless possessed of geometrical knowledge as known at that age most perfectly. Come down to the present day and you will find in this angle a law that no mechanician or artist can afford to ignore.

See how the circle is divided into 360 degrees, and these again into the hexagon of 60 degrees upon which even the honey bee has founded its cell of equilateral triangles.

Its importance is as great as that of the circle, of which it is only a sixth, and is equally perfect because it fills space perfectly, and no more or less can be crowded into the lines given.

No development of the equilateral triangle can be made except to carry out the geometrical laws on which it is based and is the first practical shape given after the "point—to a straight line—the shortest distance between two points—to a circle."

It is the basal angle of all development of form. It is proven beyond doubt in the human jaws, their creation and perpetuation and preservation without change to a higher form of organization and must ever remain the basis of this complex organism, which cannot be changed to a higher type any more than its base can be.

From what I have here shown you in this specification or description of the working model of a perfectly reproduced dental organism, with the accompanying drawings and explanation of the laws or rules underlying the whole discovery, any one conversant with mechanical drawing can construct a perfect set of human teeth as to size and crown surfaces and their positions without ever having seen an original set, and can reproduce a working model of artificial teeth which in the mouth shall work perfectly as in nature. The same rule is followed as in geometry commencing from a point.

The average jaw measures about four inches from the centre of each

condyloid process to the median line at the cutting edge between the inferior central incisors.

The measurement must be taken from the lower jaw as being the one of motion; the upper has to be made to conform to the special forms and measurements of the lower.

The centre of each condyle being the centre of motion, rotating on one condyle only, the other describing the arc of a circle by moving forward in the glenoid cavity, is the proper point from which to measure the angle. The examination made by me of 4,000 dead and at least 6,000 living jaws attest this assertion.

The average is four inches, and is as long as five in many cases of the Indian and Malay, as well as some in all nations.

The few cases where the angles do not hold true are among nations who compress the cranium. The human jaw left to its own natural development must always be an equilateral triangle, and it is shown most beautifully and completely in all embryos from the period of formation in the lower jaw. I will go so far as to state that, in the designing of the human jaw it was done by first making the lower; and the dividers, from the same standpoint, while developing the lower, when carried over the arch or outer boundary of the lower, show the exact size of each upper and the distance they should be from the lower, in order that, in the lateral and forward movement of the lower, one-half of the teeth, or, from the median line to the last molar on one side only, should be in apposition for mastication and incising.

The proportions of the upper teeth to the lower are as exact as any of the measurements shown.

The size of the arch of the lower jaw must be just one-twelfth of the main circle drawn around the equilateral triangular jaw, or the teeth could not be made to fill the space. To fill the space to perfection in any such angle can only be done by throwing everything into an equilateral triangle. No other angles will do it.

The mean diameter of the fourteen lower teeth, in line, measures the same as one line of the equilateral; when these fourteen teeth are thrown into a circle, they should completely fill that circle. (See Fig. 6.)

The six incisors mean diameter, in line, measure the same as the two bicuspids and two molars on either side, forming again an equilateral triangle. (See Fig. 7.)

The six incisors of lower jaw fill just one-third of the circle, Fig. 6, the bicuspids and molars filling the balance of the circle.

The arch of the six incisors in the lower must be one-twelfth of the main circle to permit perfect lateral movement and action of all the grinding and cutting surfaces in common in mastication and incising.

As this arch is the one-twelfth of the main circle, so it will be found absolutely correct that the one-twelfth of this smaller circle will furnish the rule which gives us the width of the central incisors of the lower jaw, and why they should be the smallest of all the teeth in the human jaws.

The grinding or masticating surfaces—I use the old nomenclature—will be found to have the same absolute shape and curves, and each tooth surface varies in depth as you leave the incisors backward to the last molar. They have ever been and must always be so.

The faces on all sides of each tooth in both upper and lower jaw vary as you find them in the arch. No one tooth can be substituted for another, nor be interchanged.

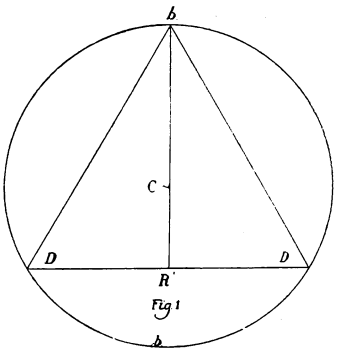
The teeth of each human being are so proportioned that the lower cannot contain the teeth of the father and the upper of the mother, or *vice versa*. The laws are rigid, or else there would be no smooth working of the teeth one upon the other in action.

It is true for the upper and nether millstones, and we could not ask less of nature's work.

Nature left to herself, always brings proportion. It is this law that is herein stated, and if law has any value as a guide, then we have it to absolute perfection in this most wonderful piece of mechanism, which has no mistake of nature on its face, but, on the contrary, the mark of retrogression everywhere depicted from civilization and man's unwise interference.

DESCRIPTION OF DIAGRAMS.—(ONE-THIRD NATURAL JAW.)

Fig. 1. Shows an equilateral triangle of four inches—the average size of the lower jaw of man, within its circle, with a vertical line from its summit to its base and at right angles with said base.



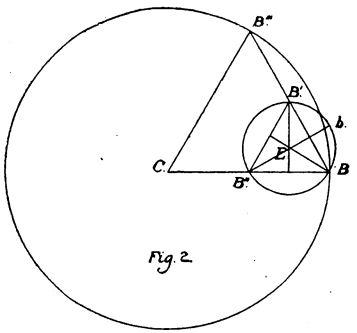


Fig. 2. The first step in the formation of the arch of the six incisors of the lower jaw, made by forming an equilateral triangle within the radius

of a circle of the main equilateral triangle of four inches, as in Fig. 2, BCB‴. Divide the line B to B‴ at B′. Form an equilateral triangle of BB′B″. Find the centre of the equilateral triangle at E, and the arc described from Bb to B′ will be the normal arch of the six incisors of the average lower jaw, which corresponds with the size of human teeth as found in any jaw of four inches, and is the same as found in Figs. 3, 4, 5, 6.

Fig. 3. The second step taken in the application of the definite arch as proportioned in Fig. 2. By placing one point of the dividers at E (Fig. 2), the centre of the equilateral triangle BB′B″ and the radius of the circle BbB′B″ and placing it at E (Fig. 3), and describing the arc aba′ intersect said arch a and a′ by placing one point of the dividers at b. The dividers placed at D and D′ and at E will also intersect at a and a′. A line is now drawn from a to D on one side and a′ to D′ on the other, which are the lines on which the bicuspids and molars are found; f and f″ being their limit. It will be found that f is equidistant between D and b and D′

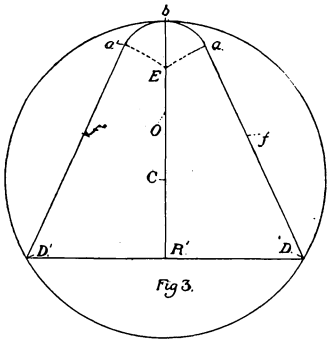
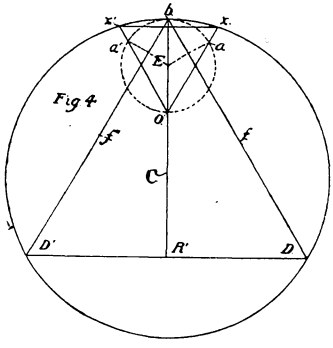


Fig 3.



and b, and the length f′ to a will be found also to be the mean diameter of the six lower incisors or the length of a line from a, b to a′ (Fig. 7). Then, as these lines are all equal, we have the six incisors and the two bicuspids and molars on either side, as in Fig. 7, forming an equilateral triangle of aba′ and o; or a perfect circle, when all united.

Fig. 4. Is the third step in showing the equilateral triangle made by the six incisors on one side or the line from X to X′, and the bicuspids and molars on the other lines from X to o and from x′ to o. The lines from O to X and o to x′ intersect at a and a′ and are fully shown in Fig. 7.

Fig. 5. Is the fourth step in the design to complete the arch of the lower jaw, given the width or size of each bicuspid or molar correspond-

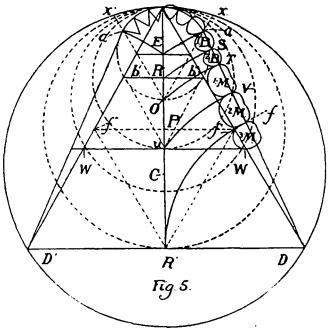


Fig 5.

ing with the first arch BB′B″ (Fig. 2), and all the succeeding arches in the main equilateral triangle DD′b until the full limit is reached for any efficient tooth.

Fig. 6. Shows the six incisors of the lower jaw from ab to a′, making one-third of the circle (Fig. 2) from BbB′B″, E′ being the centre. from a to o (Fig. 6) on one side and a′ to o on the other are the bicuspids and molars of the lower jaw, which, when drawn into the circle, form the

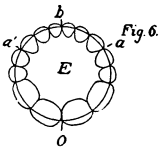


Fig. 6.

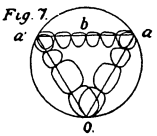


Fig. 7.

complete circle; showing that three times the diameter here, as from b to B″ (Fig. 2), will not make exactly the circumference BB′B″.

Fig. 7. The same teeth as in Fig. 6, but, when thrown into straight line they make an equilateral triangle, agreeing with Figs. 2, 3, 4, 5 and 6.

Fig. 8. Is the hexagon or six equilateral triangles representing the

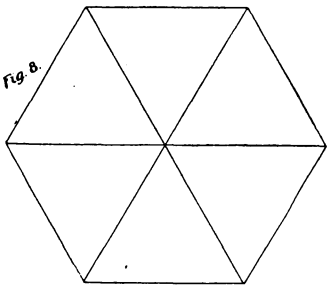


Fig. 8.

cell of the honey bee, which structure cannot be changed to a more perfect shape. The equilateral triangle, as found in all these figures, corresponds.

Fig. 9. Is the normal shape (side views) of the superior and inferior central incisors, marked SI and II, d marks the cutting edge of SI and e that of II, a is the curved line on the palatal surface of SI, which agrees with the angle of the first superior bicuspid in Fig. 10 at a. The width between d and e in Fig. 9 is greater than in Fig. 10, d and e. Figs. 16 and 17 show that from the centrals the cuspids are not so long nor the grooves so deep as one passes back to the second molar. There could be no cusps on a tooth at D.

Fig. 10. Normal shapes of first upper and second lower bicuspids which have the angle of the equilateral triangle, on grinding surfaces.

Fig. 11. Shows upper and lower central incisors of abnormal "overbite" from d to e.

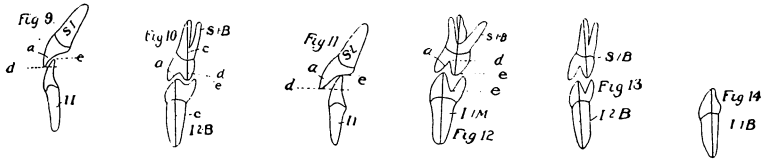


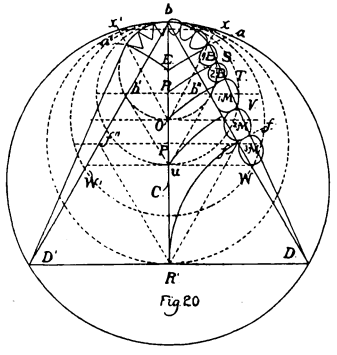
Fig. 12. Upper and lower molars showing excessive and abnormal "overbite," corresponding with Fig. 11.

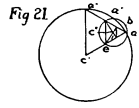
Fig. 13. Abnormal overbite of the first upper and second lower bicuspids, corresponding with Figs. 11 and 12.

Fig. 14. Shows the first lower bicuspid with but one true cusp; it should be named unicuspid.

Fig. 20 is a more complete showing of Fig. 5.

Fig. 21. Is the scale by which the width of the central incisors of the lower jaw is obtained and from this all the other incisors, the one-twelfth of the circle (Fig. 6) as found in Fig. 2, will be when thrown into a hexagon and one section of it taken and thrown into an equilateral triangle and the centre of this forming a circle and the radius will prove to be the exact





width of the central incisor of the lower jaw. To obtain the exact width of the lower central incisor take this circle, which is the same as in Fig. 2, a segment of which, from B to B′ is the exact arch of the six lower incisors, and throw this circle into a hexagon, as was done in Fig. 2, to obtain the arch of the lower incisors (which is one way to measure the circle correctly).

Take one section of the hexagon, A, A″, C′ (which is an equilateral triangle). From A to A′ will be one-twelfth of this circle or one-half the line of the equilateral triangle, A, A″, E′. Now describe a circle from within A, A″, E, and its centre will be found at C″.

Get an equilateral triangle, A, A′, E. Take the line from A to A′, at B, and it will be found to be the exact width of the lower central incisor, belonging to an equilateral triangle of the size of Fig. 23.

Transfer the circle, A, A′, E, to Fig. 22, at B, and the width of the central is found where it intersects the main circle.

The lateral is found by placing one arm of the dividers at D and the other at O, or where the circle A, A′, E intersects the vertical line R′ to b, and describing a line from O to the right, and where it intersects the smaller circle (Fig. 6) is found the exact width of the inferior lateral incisor.

The cuspid is found by placing one arm of the dividers at D and the other at c′, and draw a line to the right, and where it intersects the line from D to a, Fig. 23, will give its exact width. It will also be found that

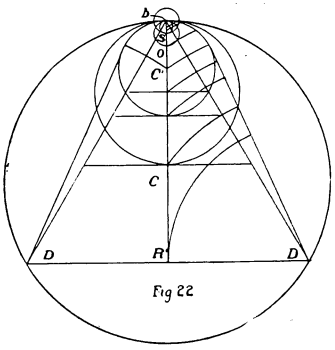


Fig 22

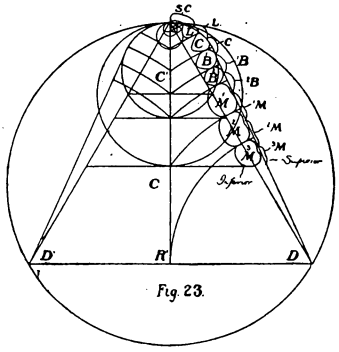


Fig. 23.

at this point of intersection of the line from D and the one from C′, that it is exactly one-third the smaller circle, and also the limit on either side of the cuspidati.

Fig. 23. Shows how the width of the upper central incisor is obtained.

Place one arm of the dividers at D and the other point at S, Fig. 22, or the centre of the circle, Fig. 24, and making a line to the right, where it

Fig 24

Fig 25

intersects the large circle, Fig. 23, which gives the exact width of the upper central and its proportion to the lower incisor teeth.

The other upper teeth are gotten in the same way as the lower, by throwing each into circles and equilateral triangles in these circles, commencing first with the smallest circle, Fig. 24.

Fig. 25 is a separate drawing of Fig. 21, A, A′, E being the point of the angles and C″ being the centre.

When these figures can be shown to be untrue to nature as I see a normal organization of the human jaws, then I will concede; otherwise I must be credited with this unique discovery, and the laws shall stand good in their application to any further development of a perfect and unchangeable organization.

Successful Prosthesis Without a Model.

By N. W. KINGSLEY, D.D.S., New York.

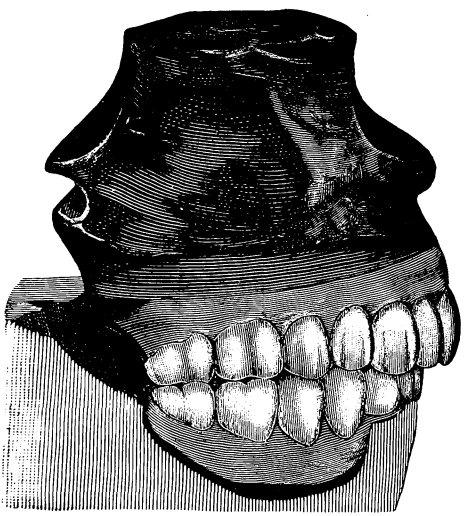
For more than forty years I have been teaching my students and preaching to others, that a correct model is a prerequisite and *sine qua non* where success is to be attained in the construction of an artificial denture. Yet I have recently met and mastered a case where it would have been so difficult, though possible, to take impressions from which a correct model could have been obtained, that it seemed advisable to proceed without a model.

The patient was a woman, adult, who is one of the unfortunate embodiments of that law in the Scripture which visits the sins of the father upon the son. Before the age of puberty and the passing of innocent girlhood, she exhibited signs of inherited syphilis. The lesion attacked the hard palate of the mouth together with the superincumbent bones, and by a slow process, continuous throughout all the years of her life, the absorption of hard and soft tissues has progressed until at present the vault is a cavernous dome which includes both oral and nasal cavities.

The bony bridge of the nose has disappeared, but stretched across the

base is a short rigid cartilaginous tissue, which, together with the anterior edge of the remainder of the velum has enabled me to sustain a prosthesis, with which she is not only enabled to masticate her food, but to properly enunciate her words in speaking, so much so that no defect is noticeable to her hearers.

To have filled this dome with plaster would not have been so troublesome as to have removed it after setting, certain irregularities and convolutions indicating that difficulty would be met. Nevertheless, had it been needful, an impression could have been taken in plaster, but as this



was not deemed wise, the comfort of the patient deciding the question, it will be unnecessary to give details of such a procedure. I will, therefore, explain what was done. That the reader may have some idea of the shape of the dome, the accompanying illustration is introduced. The figure shows the prosthesis for the upper jaw resting on a model of the lower, on which is also seen a partial denture supplied to complete occlusion. That portion above the row of artificial teeth, fairly indicates the vault into which it fitted. This portion is hollow with a hole front and back to permit breathing. The little groove in the front fits over the cartilage previously mentioned, while a similar groove at the back rests against the edge of the soft palate.

The method adopted was as follows: The patient being in the chair, plaster of Paris mixed thin, but salted to set quickly, was introduced with a knife and smeared over all the surface of one half of the dome, from

the median line down and to the remains of the maxilla. When hardened this shell of plaster, not more than three-sixteenths of an inch thick, was readily removed. A model of one side of the vault was made from this, and upon this model was vulcanized a single layer of vulcanite. This was then trimmed to appropriate shape and fitted to the mouth so that it covered one half of the vault. With this in position the opposite side was smeared with plaster, enough being carried over upon the vulcanite so that the two could be properly put together after removal from the mouth. The plaster was taken away first, and then the vulcanite piece. These were rearranged and a plaster model made, which, when completed, showed one side of the vault covered by the vulcanite, the other being uncovered. A layer of rubber was then vulcanized over this side and united at the same time with the first piece. When finished I had a thin shell of vulcanite, which accurately lined the vault, when placed in position.

This shell was then filled with plaster, which was allowed to set. Soft modeling compound was then added and the whole placed in the mouth and the bite obtained. From this, models for articulation were procured, by which the teeth were set up and waxed to the parts already vulcanized. The teeth in position, the plaster which filled the shell was carved into appropriate shape to form a proper roof to the mouth, and over this plaster was then laid a thin layer of wax, which of course was replaced by rubber in the final vulcanization which attached the teeth to the parts first vulcanized. Subsequently a portion of the dome part, was cut away back and front, to serve as appertures for breathing, and through these holes the plaster, which had supported the roof during vulcanization, was dug out. As a result the piece shown in the illustration was obtained, and all the vulcanite walls being very thin the whole fixture, though apparently bulky is lighter than many ordinary rubber plates that I have seen.

Successful Prosthesis After Resection of Lower Maxilla.

By Drs. M. L. Rhein and Charles L. Andrews, New York.

Recently we were called in consultation to see a patient upon whom Dr. Arpad Gerster had a few days previously performed an operation, which had necessitated the removal of a portion of the lower jaw from the angle forward to the region of the first bicuspid. The following history is supplied by Dr. Gerster from the hospital records:

Fig. 1.

History and Surgical Treatment.

"Five to six weeks ago, patient's attention was called to the fact that her right cheek was swollen. About three weeks ago, her dentist incised the swelling on the inner side of her right cheek, but no pus escaped—only blood. Later, her doctor also incised it further back, but with the same result. She had no pain in it, except at the time of and shortly after the incision. A few days later (two weeks

ago) she had her last lower right molar extracted, and the cavity kept open by packing. Tooth was sound and no pus exuded, only serum. She had no diseased teeth on that side. Otherwise enjoys good health. Pulse, respiration and temperature on admission, normal. Prepared for operation. Urine negative.

"General condition good, well nourished; tongue moist and slightly coated; lungs, heart, liver, spleen negative. On the right side (ramus) of inferior maxilla is a spindle-shaped, solid mass beginning from the bicuspid tooth and extending to the second molar. This mass is not painful, hard, non-fluctuating. Right molar tooth has been extracted and packing put in. Thick muco-purulent material comes away on removal of the packing.

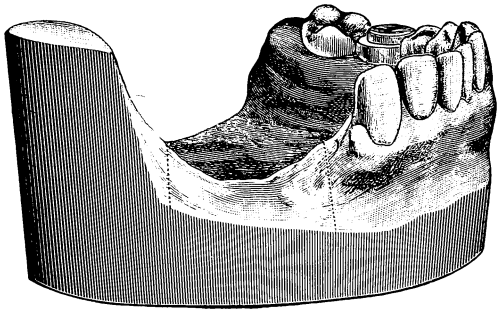


FIG. 2.

"Dr. Gerster operated March 2. Resection of jaw. No external wound made. Incision made over tumor between gum and cheek from the sinus anteriorly. Cavity opened with chisel and found to be quite large. Three back teeth removed. Cavity then enlarged with chisel, the whole of the outer wall being taken away. The chiseling extended forwards beyond the limits of the tumor, and backwards to the angle of the jaw, the outer angle of the jaw being taken away with the rest.

"Finally, the inner wall of the ramus corresponding to the site of the tumor was removed. Two iodoform packings were placed in the cavity filling it tightly, and close counter-pressure dry dressing applied. Starch bandage holding all. The first specimen removed was examined and found to be sarcomatous."

Upon examination of the patient we discovered that though the wound from a surgical standpoint was progressing in the most favorable manner, there was a great tendency for the jaw to be retracted towards the wounded side, and it was evident that unless prevented a fixed

habit would be engendered, which in the end would not only have entirely broken up the occlusion, but would undoubtedly have resulted in great external assymmetry. At first it seemed essential that an interdental splint should be introduced, and there is no doubt that when such an operation is contemplated it would be wise to construct a splint in advance of the operation, as described by Dr. Ottolengui in ITEMS OF INTEREST (January, 1897). By such means the adaptation of the splint can be accurately secured while the jaw is yet unsevered, and its application after operation is a simple procedure, while perfect occlusion of the jaws is certainly secured.

But after mature deliberation, in this case, it seemed unnecessary to burden the patient with a fixture which would necessitate absolute fixation of the jaws, and it was decided to rely upon a bandage devised and originated some years ago by Dr. Andrews. This bandage is shown in position in Fig. 1. It is made of stout linen webbing, and is of simple construction. One band passes around the forehead to the back of the

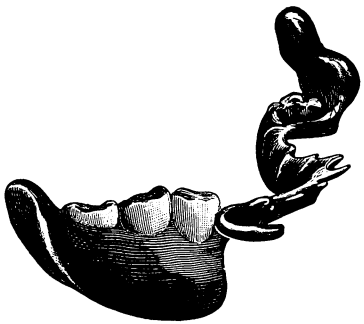


FIG. 3.

head, a second passing from the center of the forehead band back to the band behind. A third band crosses the head from ear to ear, these three in effect forming a skull cap. A fourth band has a pad fitted to the chin, and the ends reaching upward unite with the cap by passing through buckles, the ordinary woman's suspender garter buckle serving admirably in this case. By means of these ends, passing through and held by the buckles, it is possible to obtain unequal tension, so that the jaw may be drawn more tightly to one side than the other. In this instance it was feasible to draw the jaw away from the wounded side, thus counteracting the tendency for it to drift over to the severed side.

Healing was rapid, and the patient made a good recovery with no undue discomfort, and from the surgeon's standpoint the case was cured.

At this stage, however, the dentist's services were most requisite, since the patient could not wear the bandage permanently, and without it the jaw would have rapidly been drawn over towards the severed side of the bone. A prosthesis was conceived which has adequately met the requirements. Fig. 2 shows a model of the jaw, the dotted lines indicating the extent of bone removed by the operation. A gold crown was constructed for the first molar on the side opposite to the wound, and may be discerned in the illustration. This crown comprised a band and a solid gold top, which was cut away so as to furnish a shoulder. The clasp on the denture was a stout ring accurately fitting upon this shoulder, and when in position it completes the masticating surface of the crown. This with a slight clasp about the bicuspid on the wounded side, keeps the fixture in place. The denture is shown in Fig. 3. The extension seen rising above the plate proper, is a gold arm which in closure of the mouth engages the buccal surfaces of the upper molars, thus preventing the jaw from sliding over and away from its proper occlusion. That part of the extension which is seen in the figure is of gold, but the side against which the cheek rests is of pink rubber, this material proving more grateful to the soft tissues of the cheek than the metal which was used at first.

The Use of Tin-Foil in Vulcanite Work.

By ALLISON R. LAWSHE, D.D.S., Trenton, N. J.

In vulcanite work, tin-foil, when properly used, produces such handsome results and saves so much time and labor over the file and scraper method of finishing, that those who have abandoned the old method for the newer and better cannot understand why others adhere to the former, unless for the want of a reliable mode of operation. The following plan is successful with the writer:

Treatment of the Model.

Polish the plaster model with a ball of cotton charged with powdered soapstone. This fills, or partially fills, all minute bubble holes or depressions. Then coat it with mucilage or gum tragacanth and, with a ball of cotton, at once press down and burnish on the palate of the model the center of a sheet of No. 6 tin-foil (such as used for filling teeth) and work the ball outward over the ridge and backward towards the heel of the model until covered. The surplus foil may be cut away with a sharp knife and a drawing cut. Of course the foil will wrinkle and fold to a certain extent, but the wrinkles and folds can be almost

entirely burnished away. This burnishing should be continued until a high polish is attained and the model has the appearance of a polished metal die. The gum tragacanth unites the foil to the plaster and makes burnishing possible.

The teeth are now to be mounted and the case waxed up. If plain teeth are used, the labial and buccal parts, with a small scraper or other suitable instrument, are carved and modeled in imitation of the natural gum, and the entire wax surface smoothed with a fine blow-pipe flame. Then the case is flasked in the lower half of the flask (the wax having been first chilled and the model soaked in cold water), the plaster being allowed to reach only to the rim of the plate.

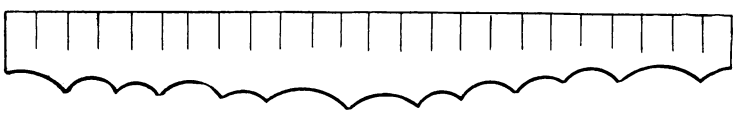


Fig. 1.

Directions for Stippled Gums.

Now if it is preferred to have the labial and buccal gums smooth when finished, and not stippled to imitate Nature, a strip of the No. 6 foil is burnished to the wax without any mucilage; the ends, and the edge covering the teeth, being turned sufficiently to be caught in the plaster investment of the second half of the flask. But if the stippled effect is desired, the strip of burnished foil is carved at the gum festoons with the point of a sharp lancet, removed, flattened, placed upon a piece of heavy foil (No. 30), the pattern marked with an excavator point and cut out with shears. The straight edge of this is then slit as shown in Fig. 1 to prevent wrinkling when adjusted and burnished to place.

The strip is now warmed a trifle, adjusted to the gums, pressed to place with the thumb and burnished with the cotton ball. The slits prevent wrinkling by overlapping. The stippling is then done by gentle tapping with a blunt excavator to indent but not pierce the foil, or by very light blows from a fine plugger point in the engine mallet. The ends need not be turned to be caught by the plaster, as the indentations suffice.

The surface of the plate next the tongue (linguo-palatal) is coated with the thin foil with the aid of the cotton ball. The surplus edges are left free to be engaged by the plaster investment. No mucilage is used.

The two halves of the flask must be separated with care for the removal of the wax and packing of the rubber, or the thin foil will tear.

Boil the flask several minutes in water until it is certain the wax therein is semi-fluid. It will then offer no resistance to the separation and the two halves will remain intact.

After the case is packed, if it is desired to close and separate the flask to ascertain if the proper quantity of rubber is present, the model is given a coating of liquid soap.

Finishing the Plate.

Finishing is very simple. When the denture comes from the vulcanizer, the heavy foil can easily be pulled off, but the thin must be removed by a bath of dilute nitric acid (about 1-5) after the adherent plaster has been scraped and washed away. The excess of rubber is filed off and the gum festoons, where needed, are shaped with chisels. The few bubble hole hillocks are broken away with a scraper or spoon excavator. Excepting where the chisel is used and the surplus rubber removed, no polishing is necessary; the case comes polished from the acid bath—beautifully polished.

Aside from the fact that the use of tin-foil saves time in finishing, it affords better results: the palatal surface of the denture is polished; the soapstone powder in large measure prevents the formation of bubble hole lumps (the few that are formed probably are caused by bubble holes just beneath, but not opening upon, the surface of the plaster model that cannot be reached by the soapstone but which the rubber breaks into); the palatal portion of the plate can be made thinner than ordinarily is advisable, because there will be no fear of polishing a hole in the plate; the rubber surface is more dense, and therefore more hygienic, than is the surface polished with sand paper and pumice; and lastly, the air chamber and rugæ can be reproduced on the linguo-palatal side of the plate, thus presenting to the tongue a more agreeable surface than the clam shell concave of the average denture.

A Radical Method of Preventing Dark Joints.

By Dr. Stewart J. Spence, Harriman, Tenn.

This is a radical method. It does not consist of some old fashioned way of packing joints, or of grinding them, or tying blocks together, or controlling the expansion of plaster investments. It goes to the root of the difficulty. With it, even badly ground joints, though using black rubber, come out free of vulcanite.

Unlike other methods, this is done *after* the flask is closed, and may

be briefly stated, thus: *Dig out the two front blocks, remove the rubber from the joints, replace and reinvest them, and vulcanize.* You cannot always prevent the rubber from squeezing in between the blocks, but you *can* cut it out *after* it has squeezed in.

In order to succeed in a first attempt, the reader will do well to observe the following instructions.

Directions for Producing Clean Joints.

While grinding up, bevel the upper borders of the porcelain gums, and also make them of even height, especially where the bicuspid block joins that of the canine. Do not allow your wax to creep over the gums any farther than this beveled border.

In investing the case in the lower half of the flask (I use the brass Star flask), let your plaster come exactly up to this border of porcelain, thus covering all of the wax and none of the porcelain. Before pouring the second half of the plaster investment, coat with some thick oil the inner surface of the upper ring of the flask. This is done that it may afterwards be easily removed, and to this end also, this inner surface should be made as smooth as possible, by polishing it as you would polish a plate.

Having opened your flask and removed the wax, cover the backs of the front gum sections with a strip of tin foil, covering all above the pin heads. This is done that the blocks may afterwards be easily picked away, as otherwise the rubber may adhere tenaciously to their backs. At the same time, it is well to further cover the three joints each with a strip of several thicknesses of tin foil—not to exclude the rubber while closing the flask—for the rubber will work its way around the extremities of these strips, but to prevent its re-entering the joint after it has been removed. Without some such precaution, the rubber, which swells slightly in vulcanizing, would in many cases work its way back into the joint, especially with black rubber, and if the waste gates were insufficient.

Before packing the rubber, cut away the plaster of the investment, to about the depth of a line, along the porcelain border, and similarly along the edge of plaster around the cast in the other half of the flask. This allows for an extra thickness of rubber along the upper margin of the gums; an ordinary thickness being liable to be dragged out of shape while removing the blocks. This excess of rubber is cut away after vulcanization.

Having closed your flask, cool it, unscrew it, and then tap the upper ring until it comes away. If it has been thoroughly cooled, you need not fear that this releasing the rubber from pressure will allow it to spread the two halves of the case apart. The cold rubber will hold them together as an oyster its shell.

Now cut the plaster away from before the incisors and almost as far back as the molar joint. With a small flame heat the thus exposed blocks, and soon they will be warm enough for you to pick out the two front sections. Now cut away with a heated lancet, the rubber which has insinuated itself into the joints. It is not often desirable to remove the bicuspids, as their anterior joint was exposed by the removal of the incisor blocks, and their posterior joint is so far back in the mouth as to be rarely visible. Besides, I fear that sections *too* closely jointed will crack, and also (as Dr. G. B. Snow has pointed out) cause warping during the contraction of the cooling vulcanite.

How to Replace the Blocks After Removal.

On replacing the blocks, it will be found that they will not return to their previous positions without some pressure, which must be maintained until they are reinvested with plaster. Besides, you need to push them a trifle farther in than the place you took them from, because they had been slightly spread by the expansion of the plaster investment and the pressure in closing the flask. To accomplish this pushing them in, I originally used (over ten years ago) screws which were made to pass through threaded holes in the flask, having long pointed ends, and turning with the thumb and fingers. Although this was a very exact method, for by patience and carefulness the blocks could be brought into any position desired, and to the utmost closeness, yet I abandoned it for the following simpler method, which answers all reasonable purposes:

Cut a deep groove in the plaster over the molars and around the back of the investment, and into this groove slip a broad rubber band, bringing it round in front of the incisors. This band, being thus stretched around the case, exerts a retracting force on the protruding blocks. Now place the flask in hot water, having first screwed it down to prevent separation of its halves by the expansion of the heated rubber. After a few minutes the rubber band will have drawn in the blocks, and you should open the flask again and examine the joints with a magnifying glass, when, if they are still slightly apart at what in an upper set would be their lower ends, remove the blocks once more and scrape a little plaster from behind the teeth, then replace the blocks, band, etc., and heat in water as before.

This broad elastic band should not be left on during vulcanization, because it occupies a place against the gum surface which should be occupied by the unyielding plaster, and being itself yielding, it may allow the blocks to be spread out by the pressure of the expanding vulcanizing rubber. If any slight spreading occurs on removing the broad elastic band, this may be remedied by replacing it by a narrow one, or by a

band of twine twisted tight on a piece of match stick, leaving these in during vulcanization. In favorable cases, the twine and match stick will serve the purpose of both rubber bands.

Now pour fresh plaster to replace that cut away, and vulcanize as usual.

If, on finishing the plate, the joints are so that the finger nail will catch when drawn either way across them, they should be leveled by a narrow emery wheel, this abraded surface being polished with the rest of the plate.

If the joints show dark from other cause than vulcanite, place along each joint a twist of cotton saturated with nitric acid, leaving it there half an hour.

Unfortunately, this is not a lazy man's method. It requires some little time. But to him whose motto is "thoroughness," it is a boon in those cases where prominent gums or short upper lips necessitate the exposure of much artificial gum, making the dull and lifeless pink of vulcanite objectionable.*

Adjustable Gum Blocks a Dental Convenience.

By Wm. H. Mitchell, D.D.S., Bayonne, N. J.

With all the efforts that have been made by the manufacturers of sectional block teeth, still there is much to be desired, and only the dentist knows the needs of the case that he has in hand. There are systems designed, and the dental houses attempt to supply that which in the offices will be adjustable to the majority of cases.

Artificial teeth cannot be supplied like ready-made shoes, and, with the best efforts of the tooth-maker, sectional blocks are not nearly as popular as they once were. The art of printing made but little progress until an accident taught the printer that separate types were superior to an entire page being made in one block, and movable type made rapid strides for the art of preservation.

With the plain teeth, the dentist is resourceful. These he can set up as the individual case may require in many instances, irregularly, so that we may meet irregular natural remaining teeth.

*A sample set of teeth sent for inspection by the author has the most beautiful, clean joints I have ever seen.—Editor.

Single gum teeth are much better, but even these, coming as they do in sets, leave something to be desired, and I have often wished that I had a single tooth in a set, or a block that had a flexible gum, or that it had a hinge so that I could bend it, and still keep the gum in alignment with the rest and tilt the tooth itself so that it would occlude as I desired.

In the March ITEMS OF INTEREST, a statement by Dr. Ottolengui (page 193) gave me a suggestion, and I submit with this a suggestion that I feel will prove to be of value in many cases.

Little pieces of gum could be baked by the tooth manufacturers out of their gum-colored porcelain, for in many cases the patient does not show the gum above the neck, and these little gum pieces set in between the teeth, with but little grinding on the back (Fig. 1), would show no joint. Then the gum could be finished, as Dr. Ottolengui says, with pink rubber.

Fig. 1

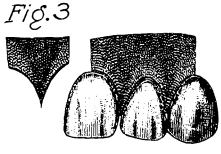


Fig. 2

Fig. 3

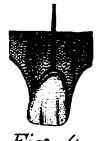


Fig. 4

In sectional blocks it is always the joint in between the teeth that bothers us most, more so than the joint in the gum, and where it is hardest to make the joint perfect, so I am of the opinion that the joint would be much better if made above the tooth, and made as shown in Fig. 2. A joint here would be exhibited by the patient less than as now made.

Fig. 3 is the same as Fig. 1, except that the gum is carried higher up in it, and will also assist in the arrangement of sectional blocks, as I suggest in Fig. 2.

There may not be any great value in this system as a whole, but I firmly believe that these adjustable porcelain gums would be useful in many ways that will suggest themselves when the case is in hand. In the case of a single tooth between two natural ones, they would fill out the loss of gum tissue on either side and make the finished whole, even if there are three pieces of porcelain, more artistic than when a single tooth and pink rubber are used. (Fig. 4.)

New Methods of Clasping Artificial Dentures to Human Teeth Without Injury versus Immovable Bridges.

By W. G. A. Bonwill, D.D.S.

After ten years, I am asked by many to revise and publish the results in my own practice of clasping human teeth. Of all I may have done in my unique and ultra systems of methods, this plan has filled a niche that would have remained a blank, for I would not have mutilated human teeth by capping for permanent bridging. So important has it grown in my own estimation, from seeing the criminal mutilation by bridging and final loss of teeth, that my voice is at highest pitch against this most cursed vandalism; and, if dentists can be recalled from their mad career, duty again summons me to the front to battle with this crime of bridging as now done by too many.

It requires no skill to whittle a natural crown to a point and slip over it a loose gold crown cap and cement it to fill up a bad fit. But it is another matter when you have to take the place of a mechanical engineer and plan and work to the finest lines without any cement to help you, and know the relative strength of your metals—how thick, how wide, how to proportion to the size of your tooth to be clasped, and the force to be contended with in mastication, that you may use all metal attachments of plate, to clasp rigidly and the stiffness of your lugs to bear the strain, and see that all fractures in bending the metals are soldered, and a thousand other *minutiae*.

No one should attempt this method who is not possessed of the talent of an engineer and has pluck and persistence to overcome every obstacle that he will find in each and every case. One prominent dentist in the West, who saw much of this work in several of my patients' mouths, tried ten times in various cases and then failed, but was honorable enough to say: "I cannot do it, but you can and I would give much to have it a success in my practice." Some have told me: "Oh! I did that years ago," but when I gave them a plaster model and asked what they would do, they could not give the details.

It is not much of a problem to clasp teeth that have parallel walls. This has been done. But even here the place where the clasp is soldered to the plate should be treated by this method, to give spring to the full length of the clasp. Some think the mystery is solved when they declare "It is this lug that does the work." It is only one factor, but in connection, bears a noble part. But it is all valueless without knowing just where to solder the clasp to the plate.

As yet I have not, in print, called attention to several points,

although in my talks I have done so. Do you know how much strain is put upon each and all teeth under a cap to hold a bridge? How much torsion in mastication, even on the flat surfaces usually made in such work? How much more strain outward as the buccal cusps of the artificial crowns are the only ones made? There is never any cognizance taken of the lingual and palatal cusps on any artificial denture. Consequently, the abutments are strained from within, out, always; and, is it any wonder they become loose and useless? The palatal and lingual cusps have each a work to do equalizing the force. The upper palatal cusps, when in contact with the lower buccal prevent any lateral movement of the upper outward or inward, and so with the reverse sides. There is always by this clasp method such a compensation from the yielding of the clasp to any undue force that, with its perfect relation to plate and teeth clasped and articulation, no injury is done to any tooth clasped.

Danger of Decay Reduced to a Minimum.

I will say here that when the plate is fitted, as soon as clasps are soldered if it is seen that one clasp or both have gotten out of place, or had not been adjusted in the plaster impression of plate and plaster for soldering, cut it off at once and make no attempt to bend it to fit. It will never feel comfortable. Do it over again. This has always been a great source of uneasiness and cause of disease and loss of teeth from decay and undue pressure. You will demand: "What per cent of your clasped teeth decay?" This is so seldom the result of this method that I do not take it into account. Teeth of poor construction and with fillings in them and exposed at the cervix from great recession of gum after extraction and absorption of the processes, will invite decay and must be watched.

If the clasp goes too far down on cervix there must be vigilance. But with every disadvantage to its application and consequently risk of caries, I hesitate in no case, knowing what I do of the amalgam I use in filling, and how with bibulous paper I can fill a shallow groove completely around the periphery of any part of a tooth clasped. Besides, the chemical and voltaic advantages from the spring coming and remaining in direct contact with the amalgam in the natural crown is beyond cavil.

The ever silent current made by the clasp on amalgam may darken very slightly the latter, but no decay have I ever found along the margins of these amalgam fillings.

Origin of the Method.

Time, with experience, levels all things. How one's practice will be changed if truth be uppermost!

I am surprised at the many summersaults I have made in nearly forty years. Because the Fathers said *"Don't,"* I did as they bade me, and should yet,

perhaps, if I had not been made of the material of which revolutionists come.

At one time I would not put in an upper plate without a suction, and never a lower one with a clasp.

For eight years gold and tin were used, but never amalgam.

The uses of contours, at first, I did not see. Its beauties were more apparent when kept out of sight. Also artificial dentures and flat grinding-surfaces. All through my early practice I was afraid of offending the Fathers, and it caused me much sorrow and heartache and kept me in poverty and made me work harder than a galley slave.

But live as long as you may, there are to be found many young as well as old persons who say, "Stop" to every new advance. Do not mind them, but strike out boldly for yourselves and humanity.

In one thing I never have changed from the beginning of my career, and that is, never to sacrifice a tooth without a struggle for its existence. A human tooth has always been treasured as a physician would the living body, and with the experience gained and ingenuity in overcoming difficulties I seldom, today, extract a tooth.

In the effort to make all plates with suction I had an experience in the loss of a superior left lateral from bad dentistry during my first year of practice, giving me an opportuity to know personally why it could not be used in mastication. I tried in vain. On one occasion, instead of removing it as had been my custom at night, I kept it in, and had finished breakfast the next day before I discovered the fact. There had been accomplished with the plate that which I had never been able to do—keep it in my mouth while eating. This was suggestive, and I applied it to others, and avoided clasping the teeth. In using only suction-plates I allowed many mouths, especially in the lower jaw, to go toothless, and yet, finally, a summersault was turned, and clasps are now used as a *sine qua non*. Adversity came still further to my aid, and it compelled me to use clasps and avoid bridging. The loss of a first inferior molar from too much cutting of bone material to gratify a great contourist, when a flat surface filling was indicated, and the "too much use of the electro-magnetic mallet" to gratify my vanity, destroyed it. He hammered the life out of it, and finally, as no one could relieve me, it was extracted. This loss was a most fortunate one for my patients, as it led me to adopt for them a plan which but for this I never should have thought of.

Up to this time I had persisted in refusing to use a clasp upon any tooth, and hundreds of cases in the lower jaw, and many in the upper, were allowed to go toothless because I could not put in artificial teeth except by mutilation and permanent bridging, which I have never done in a single case.

All practitioners who were consulted in this case said nothing but bridging would answer. Necessity compelled a violation of a supposed law, and the result has been that ever since I have been doing this class of work, no vacancy in the mouth has gone unchallenged. During all this time I had seen many cases of clasping good teeth, and the reason of decay and wear where the band was placed was apparent.

First. Any one who has any idea of pure mechanics in dentistry must admit that artificial dentures are placed in without any method, reflection or planning—certainly not as a mechanical or civil engineer would do in advance on paper—and with no system to reach the greatest strength of plate and artistic appearance. It is astounding how persons ever get used to sets of teeth where no articulation has been given. True articulation is a sealed book to the majority.

Second. Bands are allowed to go far up and under the gum-border. They are never wide enough. They have either too much spring or not enough for each individual case.

Third. The clasp is allowed to move constantly up and down on the tooth until the tooth is worn very materially.

Fourth. The clasp is soldered to the plate always in one spot—on the anterior or distal surfaces of the tooth, *just where most spring of clasp is needed.*

Fifth. The clasp has always been soldered on to the plate by fitting both to the plaster cast and soldering them immediately from that.

Sixth. This plan of soldering never allows the plate to fit as it should, since the clasp draws the plate away from the tooth, and the tooth is forced out of its place and is never easy.

Seventh. The value of the clasp is lost in not comprehending the exact relation it should bear to the plate.

Eighth. While the clasp and plate may fit well, it is always a failure if the proper articulation is not in keeping with the opposing teeth. It causes all the strain to come upon the clasped teeth, when the plate should rest easily on the gum, and the clasp be firm yet not binding on the tooth.

Ninth. *The clasp made to fit too closely to every part of the surface of the tooth enveloped results in decay, from the fine capillary surfaces made by the too near contact of clasp and tooth.*

Tenth. From the imperfect soldering of plate and clasps the bands have to be made to closely hug the surface; and, from the narrow necks of most teeth capable of being clasped, the plate is pushed too hard up against the gums, and to make the plate remain in the mouth the clasps are required to be stiffer and are never quite comfortable. There is not only wear, but caries is produced from the driving of the gum away from the cervix.

Failures of Bridges.

To add to this experience of clasping, there have been many failures from permanent and removable bridges. To grind off the entire enamel from any sound or partially sound tooth or teeth, to place over it a gold cap for one or many teeth, is the most unjustifiable of vandalisms. When I was told that the second bicuspid and second molar of the inferior jaw must be shaped to place over them caps of gold to insert a first molar tooth, I rebelled at once, as it appeared a sacrilege and a disgrace to our art.

Out of all the cases of bridging that have come to my notice, not one has been perfectly articulated. The surfaces of the bicuspids and molars have been ground flat, and, where cusps were placed on, when the jaw made a lateral movement, there was not a buccal cusp touched. The up-and-down movement alone was of any value. The cusps of gold were unsightly, and not the least art was manifest in the arrangement or in the selection of the teeth. The cement placed between the caps of gold and the tooth never fills up the space, being pushed out or away. Especially is this true of those cases where a part of the face of the natural tooth is shown from the cutting away of the gold cap.

The cement is put in so thin that it is sure to wash, or be dissolved by the powerful capillary force exerted by the oral fluids.

To add to this misery, the cervical border is seldom free from constant irritation. It is only necessary to allude to the stench arising from the accumulations upon the surface of the gold, like barnacles on a ship's bottom.

A bridge cannot be kept any cleaner than a plate that is removable, and I never saw one of the latter that did not have to be polished out of the mouth with the same care as table silverware.

The dentist who will learn to place in partial and full upper or lower sets as they should and can be, and give no trouble to the wearer, will never resort to bridging except in very favorable cases, and not then by ever mutilating a good natural tooth for a gold cap.

When a few teeth in the mouth are left without crowns, place on artificial crowns that can be clasped to hold the plate or plates in position without any fear of falling out. It is astonishing how firmly one tooth, with a properly-fitting clasp, will hold a full set upper or lower. I have repeatedly utilized an old root or roots with a porcelain crown, and, in time, should it be lost, the patient has become so accustomed to the plate that it has not been missed.

The objection to the system of bridging is that but few of even the best dentists are capable of performing the high class of work necessary to make it successful. It has been used in practice sufficiently long to

show that there never was a more signal failure in any line of work, not even copper amalgam.

I have placed on many cases of bridging by the nut and bolt, a process by which the parts could be unscrewed and removed and repaired, and then the nut replaced, and be as tight as a piece of engineering.

When I advocated the cutting of the approximal surfaces of teeth to arrest or anticipate decay, a howl went up all over the land. Now that it is "the thing" to bridge, the same men that abused me for doing what I knew was correct have no conscience in regard to mutilating the enamel of any tooth to which they wish to attach a permanent band. Their gold caps glare in the light, and make vulgarity more pitiable and the dentist more contemptible. Teeth can be clasped, no matter how much they may be out of line or at an angle with the plate, and it will be seen that they will be of far more use and more artistic.

The Bonwill Method of Clasping.

It is not necessary to fill the whole arch and palate with a plate, where a few teeth remain. A narrow, heavy plate, unyielding in character, will stay up just as well when confined alone to the alveolar border. Or where one, two or three teeth in either jaw must be replaced, they will need but one full clasp and a very small plate to act as a saddle.

When the idea is once grasped of how a clasp should be fitted to a tooth without mutilating it, and how the clasp should be soldered to the plate, then dentists will see a new era dawning upon them.

First, how should a clasp be fitted to the natural crown of a tooth to prevent future caries, and also prevent wear, and of what material and how heavy or light the metal, and how wide and at how many points upon the crown's surface should it touch to insure its steadfastness or security?

The thickness of metal is dependent upon the length of clasp, the width of same, and whether one or more clasps will be used to sustain the plate, or where there has to be very much spring to the clasp in passing over a crown that is very much out of perpendicular.

The metal should be of platinized gold only, without any lining of pure or twenty-two-karat gold soldered on it next to the crown. The metal should be loosely fitted to the crown on the plaster cast and afterwards fitted in the mouth directly upon the tooth and made to touch in at least four places. It should not be struck up to fit accurately every inequality of the surface, nor should pure gold first be fitted to the tooth by burnishing it on and then soldering that to the platinized gold.

If a clasp fits minutely all the surface of the crown, it makes of the minute space between the crown and clasp a capillary surface, and keeps

the mucous secretions, as well as the fine food, forever in contact and with no space for circulation of the saliva. Whereas, if the band touches but a few places on the tooth-crown, it will rest just as firmly if it has been well fitted in the mouth and allowed to take its own position when tried upon the crown.

Capillary power made by surfaces very closely approximated is the surest means of producing caries. Where a space is left, the points that do touch are in absolute contact, and, aside from a slight wear on the tooth, the surface cannot decay as when there is an actual and close fitting. If made of fine soft gold, there would always be danger.

A clasp is not needed to grasp the crown very closely. The width of clasp should be as great as can be made, and to steady the plate without grasping it firmly. This will be a new idea to many.

Next to the clasp in importance is to know where it should be soldered to the plate, and on which side of the crown to allow it to go on and off, where the crown is very much out of perpendicular.

In this lies the principle part of the plan, and upon it depends entirely, or greatly, the success of the operation. The plate may fit perfectly, and also the clasp, but all is vain unless the point is known where to unite the band and plate.

This cannot be done unless a plaster impression is taken of both the clasp and the plate in the mouth, so that the exact relation is obtained. The impression of plaster is now run with plaster and sand and the case soldered. To make the whole thing a perfect development the little gold angular tip must be soldered either to the clasp or the plate to keep the clasp from moving up and down.

It should be made of very heavy platinized gold and fitted to the top of the crown around which the clasp goes and upon that part of it that will be free from the antagonism of the opposite teeth. The side of the crown should be selected and marked by observations made in the mouth at the first visit. These can be fitted on the plaster cast.

When the impression in plaster has been taken of both clasps and plate, the easier plan will be to pour plaster and sand into it, and it is then exact, all ready for soldering.

Before any teeth are placed on it, by all means try it in the mouth to see if it will go in and out; for unless the impression has held all the pieces in exact apposition, the plate will not go in or be removed easily. A little filing may be needed to help in the adjusting. Frequently, where the tip rests on the grinding-surface of the crown, the latter has to be ground to let it rest firmly, which keeps the plate from anything more than resting in direct contact with the gum. This must be adjusted very accurately, and the plate will act as a saddle on the gum to prevent riding.

This rest prevents any changes of position of the clasp on the tooth, and also any chafing on its surfaces. It is an absolute necessity. It is better it should be soldered to the plate than upon the clasp, as there will be more steadiness; but it must not interfere with the spring of the clasp. The drawings will show the best place for them on the tooth-crown. They should be very strong, as the force of mastication falls upon them. Use eighteen-karat solder for every attachment. These tips can rest on either a gold or amalgam filling, or the body of the tooth. If the latter, the enamel may be cut to prevent the antagonizing tooth from touching the tip.

Where there is decay upon the tooth to be clasped, I prefer to use amalgam containing much gold in it. There need be no fear of galvanic shock so long as the clasp is in direct contact with the amalgam.

My long experience with amalgam in these cases assures me that there is no action between these widely dissimilar metals to deteriorate their qualities as preservers of tooth-substance, but the reverse; and the gold amalgam does not discolor to any extent.

I prefer to allow the edge of the filling to stand outside of the clasp and not rest underneath it at the top or next the grinding-surface, and I do not hesitate to use the corundum wheel upon the enamel where slight projections interfere with a clasp resting securely. No harm can result where the cut surface is polished. If caries should occur at any point thereafter from accumulation of food, I should fill with amalgam. But this need not often result when cleansed after each meal.

As I have already stated, the injury done to the tooth where a clasp is upon it is from the food being allowed to remain for weeks in contact—never from the clasp where it touches, unless too accurately fitted.

Each case must be thoroughly studied after the plaster cast is made, or the result will not be satisfactory. The points on the clasp and plate where the bar is soldered to connect them *are the vital parts*, and, unless judiciously chosen and the bar made of platinized gold wire and the base-plate of two pieces of gold soldered together to stiffen it, and the clasp of proper width and thickness, the strain placed upon the mechanism will break it. The bar holding the clasp and plate must always be upon the side of the tooth where there will be least resistance. Take a second inferior molar that has tipped forward very much and also inclines to the tongue. Here the soldering should be done as far back on the buccal side of the clasp as can be accomplished. Then the spring of the clasp is not needed for the buccal side, but for the anterior and lingual sides, where projecting from a perpendicular. If soldered from the lingual side, it would be impossible to get the clasp on or off.

In the upper cases it is generally the reverse, although there are

many exceptions, and no rigid rules can be laid down. Each one must be specially studied, or no good results. Nor can you rely upon fitting plate and clasp to the plaster-cast and soldering from that. Take the trouble to take impression of both plate and clasp in the mouth, and then solder from that.

A study of the cuts will give an idea of this work, but it will not appear so clear until it is attempted. The articulation for one or two teeth I do directly in the mouth, but for three or more I prefer my articulator, and put on the minute details after the teeth have been attached.

Cases Illustrating the Method.

The letters on each cut have reference to the same parts on all. Fig. 1 is a case for first upper bicuspid, right side. A filling of gold was placed in the distal surface of the natural cuspid with a hole, *c*, drilled into it for the pin in Fig. 2. The second bicuspid had also a large amalgam filling, around which the clasp was placed, so that it would not show from the mouth. Fig. 2 gives the plate

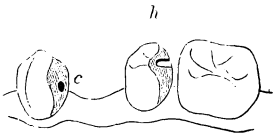


Fig. 1

Fig. 2

with English crown thereon, with pin soldered to the plate. The clasp has a tip at *h* soldered to it, and *i* is the heavy platinized gold bar, showing how it forms the attachment between plate and clasp, and just where; *c* is a pin, soldered directly to the plate, which enters the hole in the gold filling shown in Fig. 1.

Where no filling is in the cuspid I should use a short clasp fitted near the cervix, to reach from the palatal surface to the buccal, where it would not show from the outside, and soldered on the extreme palatal side to gain a spring.

Fig. 3 is the skeleton of a plate without the crown, which shows clearly the case for which it was made. (See Fig. 5.) In Fig. 3 is *e*, the tip, resting on the second molar, soldered to the plate. On the plate next to the second bicuspid is soldered an upright with a tip, *e*, and a thin, narrow projection underneath it, which sets in a groove shown at *d* in Fig. 5, in an amalgam filling, to keep the anterior of plate in position and to prevent the plate from pressing too hard upon the gum; *i* is the

bar connecting plate and clasp on the lingual side. One or more pins for the crown can be used.

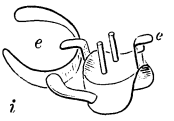


Fig. 3

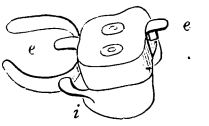


Fig. 4

Fig. 4 shows the same with the crown cemented on with oxyphosphate, or vulcanized, or with gutta-percha.

Fig. 5 is a case, left side, lower jaw.

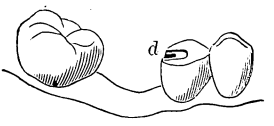


Fig. 5

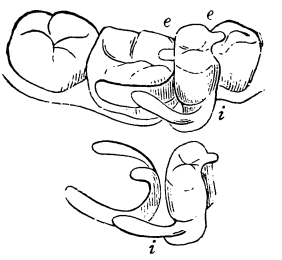


Fig. 6

Fig. 6 is a second bicuspid tooth, right side, lower jaw. The bar *i* is soldered to the plate and clasp on the buccal side and the tip on the clasp on the first molar, and, as the crown is made entirely of gold, the tip is soldered directly to it to rest on the first bicuspid, and the anterior surface of the gold crown is made concave to fit into the distal surface of the first bicuspid, which prevents any movement laterally. A gold crown is used, as it is not seen, and facilitates greatly the soldering and adds immensely to the strength, and there is no danger of repairing in the future. The back tip, which rests on the molar, should have been soldered to the crown also, and less strain would come on the clasp.

Fig. 7 is an extreme case of tipping of the third molar, lower jaw, right side. The clasp was soldered to the plate on the buccal surface, and the plate at the second bicuspid was held as in Fig. 4. It could have been done by a narrow clasp to reach only partially around the second bicuspid, where it would not show on buccal side.

Fig. 8 is another extreme case where the second molar in the lower jaw projects towards the tongue and the second bicuspid towards the cheek. In this case the bar should be soldered on the buccal of the molar near its distal proximal surface at *b*, and the second bicuspid on the lingual surface at *a*.

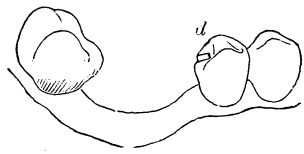


Fig. 7

Fig. 8

Fig. 9 is a section of the first and second lower molars attached to a very slanting wisdom tooth and the second bicuspid, which has also a slant. From the extreme angle of the third molar it would seem to be impossible to fix a clasp to it securely. But this has been done. Fig. 9 is the inside or lingual view showing clasps *c c* lugs *l l*, and where soldered at *s s* to *p* the gold plate. Fig. 10, outside of buccal surface giving the exact place where the bar of platinized gold is soldered to the plate at *c* and *s* on both the bicuspid and third molar.

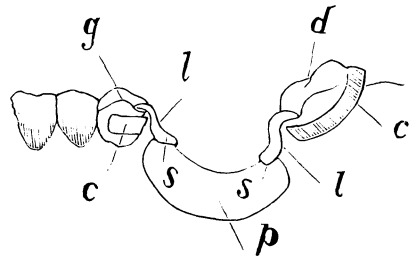


Fig. IX.

This far away point of the bar that connects plate and clasp gives the clasp all the free spring possible, and when in place hugs the molar firmly and is never detached by use. The lugs *l l* are soldered separately to the plate, and the crown surface of both bicuspid and molar should be cut to allow it to fit clear of the antagonizing tooth above. The lower molar at this pitch never needs any cutting. The lugs should stand free of the clasp and, where bent at an angle, always be sure there is no crack from the bending. If so, solder it. Always make them, as you do the clasps, of platinized gold. Figs. 11 and 12 show a first upper bicuspid held firmly by the arrangement of the clasps. The tooth lost was a first

bicuspid, the cuspid never having appeared. Here I had to anchor around a lateral and second bicuspid. This has always been a problem not answerable heretofore by any clasp method. Fig. 12, inside or palatal view. Clasp *c* is neatly fitted to the left lateral, encompassing the whole circumference of the lateral on its palatal surface, and where it is soldered at *a a*. The angle of incisors here answers for a projection to hold from slipping down upon the gum. The lug *l* rests on the second bicuspid. The clasp on the buccal sides should never go far around. See *b b*, Fig. 11.

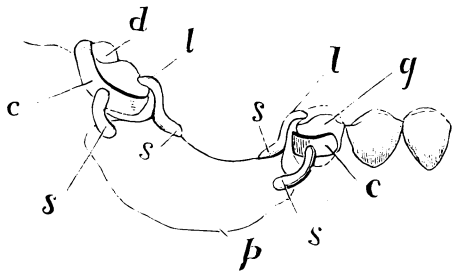


Fig. X.

It is always better to so clasp a tooth that the plate will not pull away from the tooth clasped. If this is not observed, in cases where you depend on the lug resting on a good crown, the force used in mastication is so great as to draw the clasp away that does not envelop the tooth

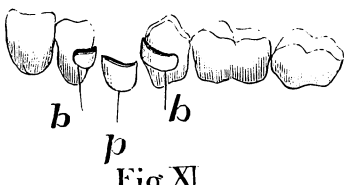


Fig. XI.

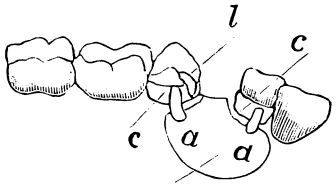


Fig. XII

fully. Where the plate is resting on good roots then no separation occurs. An *incisor* or *cuspid* can be clasped with facility by giving all the spring possible to the clasp and having the metal as thin as it will allow to insure strength, with full elasticity.

A shallow notch cut in the cuspid or lateral on the palatal surface to let in a lug, will not cause it to decay and assures success and no injury. Between the cuspid and second or third molars there is no difficulty in sustaining a plate that will not yield to mastication in either jaw.

Fig. 13 is a case in my own mouth for an upper left lateral and on the right a second molar and the left the first and second molars are given. This is held by the one clasp on the right side around the first molar, and none on opposite side. Lugs are also vulcanized into the rubber and materially helps mastication. The gold plate is cut out to allow of full taste and no obstruction to the tongue. It has been a perfect success for five years.

No system of bridging could have been adopted to have given the least assistance that would not have caused the loss of the teeth with gold caps to sústain the separate cases. A suction plate would have been the only other plan, but what a nuisance for four teeth. The one clasp around the first permanent molar made by this system has been a success. All the molars were lost at twenty-one years of age, when all could have been saved, but a dentist in Philadelphia, who gloated over extract-

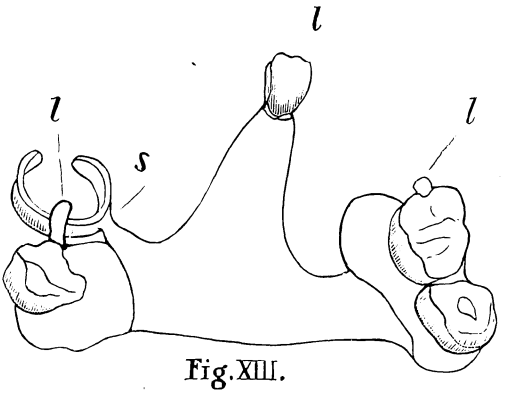


Fig. XIII.

ing human teeth, without any close examination as to their value, did a criminal thing when he extracted them. I have lost six teeth in sixty-six years and but one had a pulp exposed. The best operators were employed. This was perhaps well for those to whom I have given my life. It has made me jealous of every tooth and no vigilance is too severe in the work of treating and saving human teeth. Adversity to me was a boon to others.

Fig. 14 is a very extreme case where the second bicuspids are clasped on both right and left sides. The divergence is marked, yet with the bars soldered at *s s* with the lugs *l l* fastened very near the bar that supports the clasp on the plate, success was attained. This is an exceptional case. Usually, the lug should be distinct from the clasp. The gold plate *p* is very heavy and extends well back on the plate. In this case, as in quite all clasped plates, the clasps are not placed on both natural teeth

at the same time when trying in the mouth. In this case, the one on the right side first, then the other is pressed outwards over the crown when it goes on easily. In removing the plate from the teeth, the clasp on the left, or the one placed up last, must be started first and the other easily follows. But both will not come off at the same time. Fig. 15 shows the loss of a bicuspid natural crown with the roots perfectly healthy and in place. The first molar is gone with the roots. Both these teeth are held

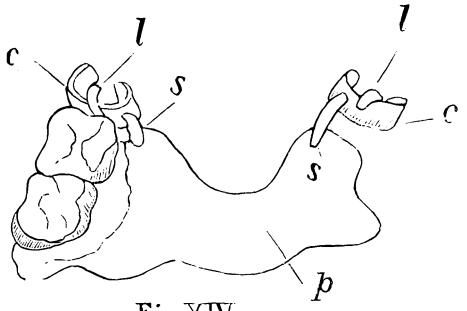


Fig. XIV.

in position firmly by the clasps being soldered on this principle, at *s s* with lugs entirely separate from clasps. The gold plate rests firmly against the cuspid at *c* on the palatal side. The root of bicuspid is firm and healthy and supports the plate without moving.

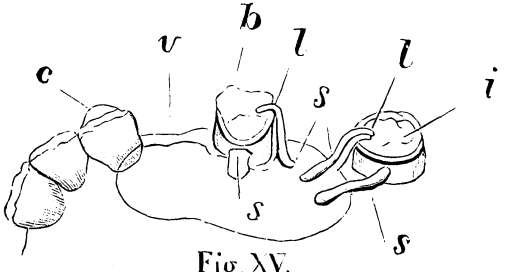


Fig. XV.

I cannot urge too strongly the retention of all roots that can be made healthy when no crowns can possibly be placed on them. When allowed to remain, and these plates fitted directly upon them, they become firm and non-irritant, and enable the same pressure to be used on the artificial teeth as on the natural ones, and are clean as any part of the mouth. I seldom remove a root that can be reclaimed. The satisfaction to the patient is immense. The retention of one tooth, either with natural crown or artificial, is enough to hold in position a full upper set with a plate very

narrow and confined alone to the alveolar border, and with no suction, provided the articulation is perfect.

I can further assure the far more perfect success of these operations if the clasps are made to touch not more than at three or four points on the crown. Where fitted accurately, caries is doubly invited by capillary action.

Not least of all the virtues of this class of operations is that the average dentist in plate-work, or even the operator, can learn to successfully do it, when but few can pretend to do a respectable piece of bridging.

While it is so easily done if nice care be used, I do not wish to be understood that I would have any tooth extracted, knowing that it could be replaced so handily and to such perfect satisfaction to the patient.

I wish it further understood that the patients for whom I did these operations were not mine originally. I am thankful that from the very first of my career I have held the human tooth so sacred, and as years advance I am jealous of every root that can be at all utilized; and I believe I am clean in such matters, and keep my patients so, or I could not have laid claim to have extracted so few teeth from any cause. Whatever there may be about this method that is original, I freely tender it to the profession as not only worthy their serious attention, but free from any restrictions.

Crown and Bridge Work

A Method of Making Cusps and Dies for Crown and Bridge Work.

By H. J. Goslee, D.D.S., Chicago.

While the application of porcelain to crown and bridge work materially enlarges the field of possibilities and furnishes the very ideal of modern prosthetic dentistry, yet the conservative indications for its use are so restricted by conditions of absorption and occlusion, that it will never occupy the same sphere of general application and usefulness as gold. Hence in conceding the many advantages possessed by porcelain, it is neither advisable nor practical to consider gold work as relegated to the background, because of our achievements in other lines, for in many ways nothing will ever take its place.

Importance of True Occlusion.

While the detail in the construction of crowns and bridges in gold is perhaps familiar to all, it is apparent that many seemingly fail to recognize the very essentials upon which ultimate and permanent success depends. We acknowledge that a crown must fit, and readily grant that it should be *contoured* and shaped so as to restore the points of contact with the teeth approximating it; that it should preserve a symmetrical alignment and possess the characteristics of corresponding teeth, yet the one important essential which renders it not only artistic but useful—occlusion—is oftentimes entirely overlooked.

Too much emphasis cannot be placed upon the importance of occlusion in bicuspid and molar crowns, yet how little progress has really been made in the manipulative procedure of procuring the outline of these surfaces for gold crowns and porcelain-face dummies for bridge work, and, as a rule, how little accuracy is usually obtained?

Throughout the entire evolution of the method of securing these cusp forms, the same general principle, that of stereotyped typical cusps, has been maintained, yet the fallacy of expecting a ready-made cusp to fit the edge of a properly contoured band and then occlude accurately with the opposing teeth is significant in even the average typical and normally posed cases. It is beyond reason to expect it, and I am of the opinion that it is equally as necessary and important to make a special die and cusp for the individual case as it is to make a band to fit the root.

The method which I now use and take pleasure in outlining here is new only so far as the modifications are concerned, and is merely a development of the old method of Dr. Kingsley, of securing and making cusps for the case in hand from an imprint of the occluding surfaces of opposing teeth. The modifications render it equally as applicable to dummies for bridge work as to crowns, and the detail is more simple and expeditious, combined with a result more accurate and artistic.

For crowns the variation between the size of the root and the dimensions of the space to be filled should be noted, and the band cut so that an allowance for this variation is made in a difference between the circumference of the cervical and occlusal edges when soldered.

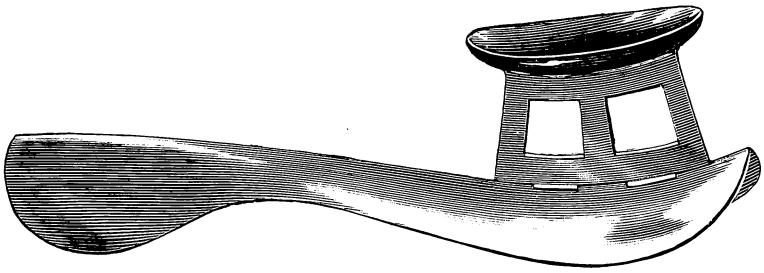


Fig. 1.

This will enable one to secure not only a tight fit to the root, but such contour as is necessary to restore contact points and alignment. The cervical edge after soldering should first be festooned, or slightly concaved upon the approximal sides to allow for the dipping down of the alveoli between the teeth, so that the bands when in position will pass beneath the gum line a uniform distance at all points. The band should then be fitted closely to the root, passing just freely beneath the gingival border of the gum, the occlusal edge cut the proper length to allow for the depth of cusp, properly shaped with pliers and filed smooth. If sufficient care has been exercised in the preparation of the root, no great effort is necessary to obtain this adaptation without inflicting much pain to the patient, as but little force is required in pressing the band into place, and it certainly *never* becomes necessary to *drive* it rootwise, as is frequently done. When the adaptation is completed and the band is in position, the bite and impression are taken, allowing the former (taken in wax) to precede the latter always. The impression must necessarily be taken with plaster as no other material is reliable for any work of this nature. Considerable time may be saved by taking both

the impression and bite at the same time in plaster, which can be easily accomplished by using an impression tray designed by myself for the purpose (Fig. 1).

In using this each side is filled separately (Fig. 2), the whole then placed upon the articulator, the pin removed, and the models separated. The pin is then readjusted and the models brought into direct occlusion, which, of course, gives exact reproduction of the relation in the mouth.

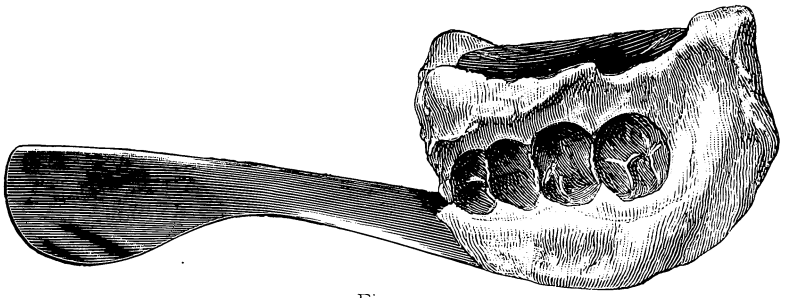


Fig. 2.

The surfaces of the models in close proximity with the band are then varnished with collodion or silex, and the band filled with thinly mixed plaster, into which the occluding surfaces of opposing teeth are imprinted upon closing the articulator (Fig. 3).

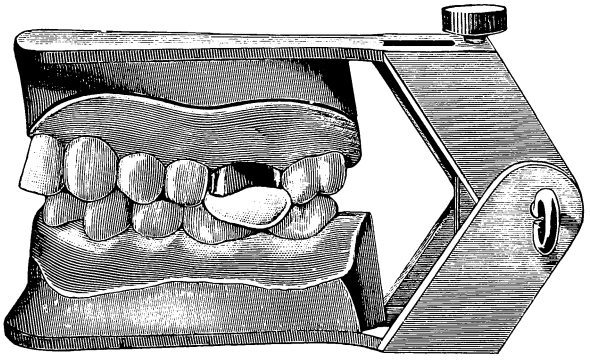


Fig. 3.

The surplus plaster around the outer edge of band is first removed after articulator is opened, which leaves the remaining contents forming a crude cusp (Fig. 4), but one that occludes perfectly, and that is the exact size and shape of the band.

While this is the result usually obtained by former methods of a similar nature, we do not stop here, but proceed to apply some little

artistic skill (which can be easily acquired) to carving this plaster outline into a more typical form by properly placing the grooves and pits. This is very important from an artistic standpoint, and in no way need change the occlusion perceptibly. In fact, it betters it because the formation and separation of cusps upon the surface when reproduced in gold makes the crown more useful than a surface too smooth, by facilitating mastication (Fig. 5).

Modeling compound may sometimes be employed, but when carving is to be done it is not desirable because of the tendency to chip or flake, and to change form under pressure such as is necessary to get a perfect mould in such substances as are used for the purpose. A little study of cusp formation will greatly facilitate the carving, and the same can be acquired from natural teeth, models, or the adjacent teeth on the plaster casts. After this plaster cusp has been carved to suit the case, it then

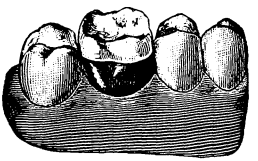


Fig. 4.

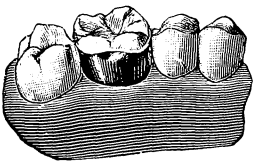


Fig. 5.

becomes desirable to decide whether a solid or cast cusp or a swaged cusp is preferable for the reproduction in gold. If the solid cusp is wanted, a ring or ferrule of brass is filled with mouldine, into which the plaster cusp is imprinted to a depth even with the edge of band, placed over a Bunsen burner and dried out until crystallized or hard; then scrap gold is fused in this mould, and when molten, cast by pressing into matrix with a smooth piece of carbon or steel large enough to cover the cusp area. Cast cusps, however, are of no advantage, for to swage them brings out the finer outlines of the carving and results in a more perfect reproduction, and they can then be filled with solder when uniting cusp to band and made as heavy as is ever necessary, and, moreover, considerable time is saved in filing and dressing down to evenly approximate the edge of band.

For a swaged cusp the plaster forming same should be trimmed down along the peripheral border just enough to expose the edge of the band. This is materially important as it allows for the thickness of gold used for cusp, and so renders possible a perfect approximation of the edge of cusp to band, which could not be procured without such an allowance. The metal ring is then filled flush to its edges with mouldine, into which the plaster cusp is firmly imprinted just far enough to outline

the exposed edge of band. When the mould has been secured, a small air-vent is made by passing a piece of fine wire through the mouldine from the under surface, and we are then ready to make the die and counterdie. A funnel-shaped cap of metal or hard or soft rubber (Fig. 6) having a flat base of equal diameter with the metal ring, and a small perforation through the center, is then placed over the mould and the

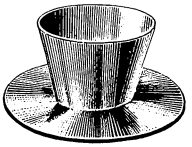


Fig. 6.

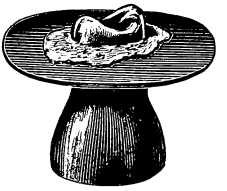
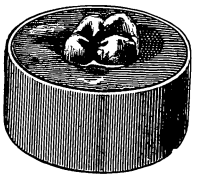
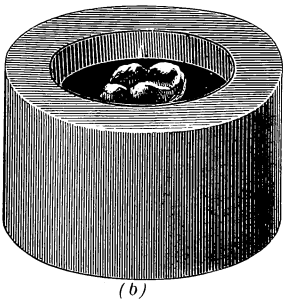


Fig. 7.

button or cusp cast of pure Watt's metal by pouring the same into this cap. After the metal cusp cools sufficiently, it is easily separated from its attachment through the small perforation to the remaining portion of metal, and is a perfect reproduction of the plaster contents of the band (Fig. 7).



(a)



(b)

Fig. 8.

This cusp button is then placed upon the opposite side of the ring containing mouldine (Fig. 8a) and carbonized nicely, which can be most easily accomplished by igniting a small piece of gum camphor which deposits a beautiful layer of carbon without generating any perceptible degree of heat. The rubber ring is then adjusted (Fig. 8b) and the counterdie run of Mellotte's metal, or fusible alloy (Fig. 9).

The gold forming the cusp is now swaged into the counterdie with lead in the shape of a small ingot or bullet (Fig. 10), and after being conformed to the proper shape the surplus is removed, and then the button is used to bring out the finer lines (Fig. 11).

The Watt's metal is used to form the cusp button for two special reasons: First, it is harder and higher in fusing point, which precludes the probability of uniting the two by pouring one upon the other; and, second, because it is impossible to swage or conform to a desired shape a piece of gold or other soft metal between two like surfaces of even

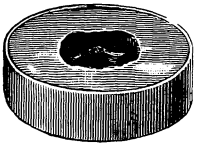


Fig. 9.

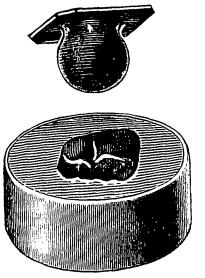


Fig. 10.

Fig. 11.

resistance, without stretching the gold very materially. Something must give in this procedure, and unless one of the dies is softer and more yielding than the other, the gold will suffer and be much altered in thickness by the time it has been properly swaged, and it is most noticeable around the edges.

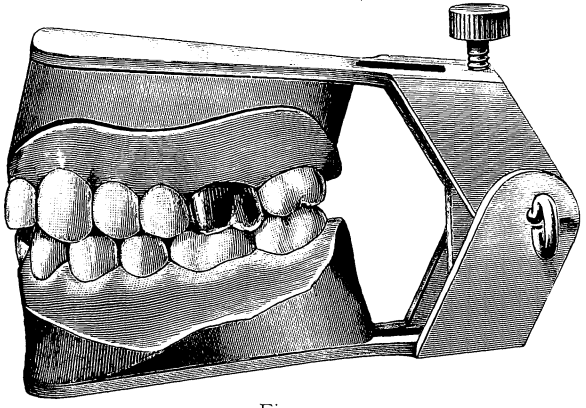


Fig. 12.

After the gold cusp has been formed the band is then placed in position upon articulator after the removal of the plaster cusp, and the gold cusp trimmed down with a file until it perfectly approximates the edge of band and admits of the closure of articulator into occlusion, then wired together and soldered, without too much deference to economy.

The result is a perfect occlusion, with an almost imperceptible seam of union between band and cusp, and yet is accomplished in about the same time ordinarily consumed in selecting one of our numerous ready-made cusps and fitting it to the band and occlusion with only a faint hope of success and accuracy (Fig. 12).

These same general principles are applicable to the construction of porcelain-faced dummies for bridge work, and it is needless to say in conjunction that these should occlude just as accurately as the crowns, if our desire is to reproduce or improve upon the natural condition of beauty and usefulness. In bridge cases the abutments should always be completed first, as also should each individual part be finished before they are finally assembled or united. This so modifies and facilitates this operation as to render it simple. After completing the abutments they are placed in position upon the roots, and the articulating bite and impression taken in plaster as described. When this is filled, separated

FIG. 13.

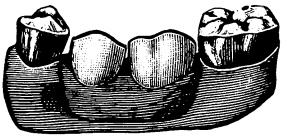


FIG. 14.

and placed upon the articulator the facings are selected, ground to fit and backed with a single backing of 34 gauge pure gold, because the cusp here will form the reinforcement. The occlusal edge of the facings should be beveled to a thin edge to enable the backing to be closely adapted to a fine finishing edge, with proper protection to the porcelain; and the cervical edge should, after being ground to fit the gum accurately, be so rounded and smoothed as to prevent the occurrence of hypertrophy of gum, which will result if this edge is left at all rough or sharp. The backing should only extend as far cervically as to take in the pins nicely, and should never project far enough to pass between gum and facing when in position. A small surplus of backing should extend beyond buccal surface of facing and at right angles with it, so that the edge of cusp may be placed against it to protect the occlusal edge (Fig. 13). The facings are then placed in position on model and retained from the outer surface, so that their backings may be exposed (Fig. 14). At least one of the pins should be left to hold the plaster which is now poured against the backings and into which the occluding teeth are imprinted. Use ordinary means to prevent the plaster from adhering

to any surface but that of the facing. After hardening, this plaster cusp is trimmed and carved as before described (Fig. 15). Then follows the making of the cusp-button, counterdie and swaging of cusp. In fitting the cusp to the facing, avoid the showing of too much metal along the occlusal edge, overhanging edges and too close proximity. After fitting nicely, invest and solder each dummy separately, and in so doing, so fill in or render convex the lingual surface that it may be self-cleansing when in the mouth, as too much attention cannot be given to this important phase of bridge construction.

While it is important that the lingual surfaces of these dummies be of a general convex shape, it is by no means necessary that this condition be secured by filling in solid with scrap gold or solder, for after sufficient reinforcement of the cusp in uniting it to the facing has been obtained,

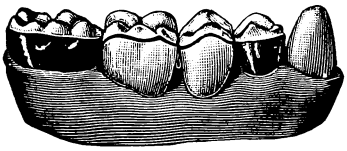


FIG. 15.

FIG. 16.

this general shape can be given by fitting and shaping a piece of plate gold to form the desired convexity, with the advantage of economy in both material and weight of finished product. After investing the facing and cusp sustained in their proper relation, a piece of plate gold cut similar to a crescent in shape can be fairly closely fitted to the inside of the cusp and backing (Fig. 16), so as to give the desired form to this surface. Then, after soldering the cusp to facing with a sufficient quantity of solder to well reinforce the cusp in thickness, this false back can be placed in position and soldered around the edge of its contact with cusp and backing, and the result is obviously all that is desirable, with the above mentioned advantages.

Whether for a single crown or an extensive bridge, this detail is simple, expeditious, artistic and accurate. Can the modern operator wish for more or less?

Correct Occlusion, Cast Dummy Bridge and Crown Work.

By CEPHAS WHITNEY, D.D.S., Kingston, Jamaica, B. W. I.

Causes of Failure in Bridge Work.

This class of work, as usually made, by casting in cuttle-fish or otherwise, is faulty for the two main reasons here stated:

First. Lack of speed in construction.

Second. The occlusion is either open and useless in places, or "interferes" badly the moment any of the lateral or anterior positions of the lower maxilla are attempted.

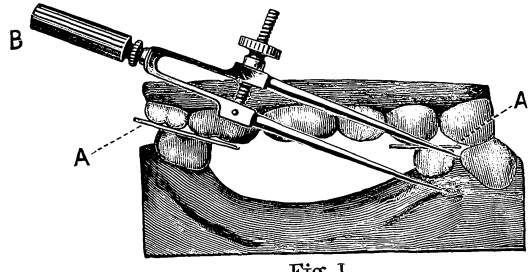


Fig. 1.

The latter is a more serious point than many bridge workers are aware of, as it is the cause of many loosened "pier" teeth, and loosened or broken bridges. Then again, though some men are clever enough to obviate this interference, their occlusion is still often faulty, as the power is not equally supported along the *whole* surface of the bridge when these subnormal movements are assumed. In the following description of my system, these points are dwelt upon and a method shown for their correction.

Correct Construction Described.

We will assume a case in which the lower right second bicuspid, first and second molars are missing, first bicuspid and third molar being in position to be utilized as piers to support the bridge.

In constructing the gold crowns, their occlusal portions are fashioned in the same manner as the intervening structure, therefore, a description of the former will almost do for the latter. I described this crown in ITEMS OF INTEREST July, 1896, but it will be necessary to go over the same ground again, as improved methods will be introduced.

In grinding occlusal surfaces of pier teeth, see that sufficient is removed to allow at least (this is minimum) 27 plate, B. & S. gauge, to rest upon whole surface and yet not interfere with occlusion, as shown in Fig. 1. A, being plate.

With small bow compasses, measure for height of bands. See B in Fig. 1. Use this to scribe on gold plate. See Fig. 2.

I will here state that I will only dwell upon those points which are original with myself.

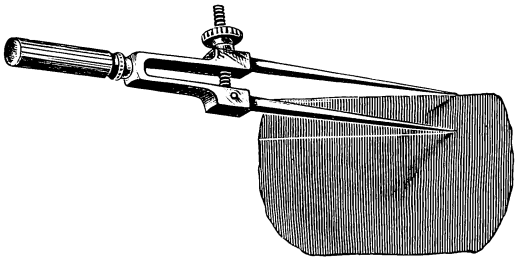


Fig. II.

After bands are fitted as usual, their occlusal edges can be made fair by using a large fine file, one that is wider than band. Try them on teeth to see that there is no interference in multiclusion. At this stage, teach patient the act of multiclusion. This word I have coined to desig-

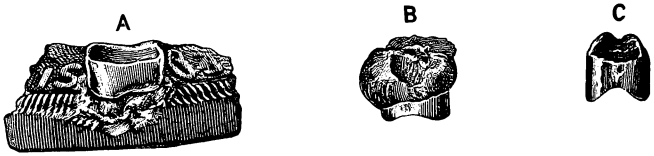


Fig. III

nate all those movements of which the lower maxilla is capable. In any case, they must have practiced it before the next step is taken, for reasons which will appear.

Heat bands in flame until they will burn their way into modeling composition, occlusal edge down as shown at A, Fig. 3.

Allow bands to remain in composition a moment, until a small quantity of composition will adhere to end of each band on removal. Too quick a disturbance will be disappointing, as there will not be sufficient composition on the ends of bands.

Pardon me if I seem prolix, but my excuse is that all these little details are essential to success, and a successful bridge made by this process is a most satisfactory affair.

Trim off interfering composition where bands touch adjoining teeth. Proceed now with each tooth singly as follows:

Place small napkin in position and moisten well the end of second finger of left hand. Pick up with foil carrier an appropriate ball of composition, the size of which may be judged by experience; of course a surplus is necessary. Soften this well by dry heat and place it on dry occlusal edge of band, where it will adhere. To remove the foil carriers, place the moist finger on soft composition to hold it back. The finger may be quickly removed as it will not adhere, being wet. Remove napkin and request patient to perform the act of multiclusion.

For a sharp bite, sufficient composition should be used and it should be soft. On cooling with ice water, see that the cheek and tongue have not disturbed bite; this is accomplished by repeating it, cold.

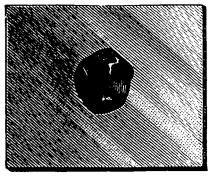


Fig. IV.

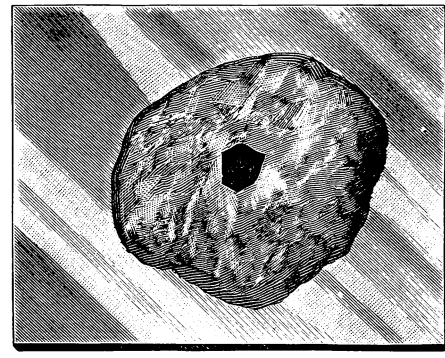


Fig. V.

This act of multiclusion in modeling composition is the key to the whole operation. Some persons will try your patience considerably before they learn to do it correctly by volition. Though they will move their maxillary in all conceivable positions unconsciously, they find it difficult to move it intelligently when asked to do so. Frequently, it is best to teach some to go through these movements without separating their maxillaries; again it is necessary to allow others to open a little now and then. I recommend a gliding movement, no separating of the teeth in their respective maxillaries.

B, in Fig. 3, portrays one of the bands with its bite untrimmed. C, in Fig. 3, shows it trimmed.

In trimming, be careful to keep the bite hard by frequently dipping it in ice water. If it is a particularly unideal impression, it may be well to alter it sufficiently by trimming—(but no building for fear of interference)—to suit your ideas from an æsthetic standpoint.

With a flat ended tool, which should be approximately the shape of the band, only a little smaller (wood will do), push bite away from band by passing through cervical end of same. If composition is unequally distributed inside because of cavities in tooth, adjust a pledget of cotton wool to cover composition first. Again, it is necessary to cut out or level composition inside somewhat, when band is undercut.

With a very thin, sharp blade (I use a worn spatula) trim off all composition to a level with impression made by occlusal edge of band, or nearly so, and finish on stationary piece of leveled sand paper. Barely moisten the smooth surface of pattern (this term will now be used in the place of bite) with Canada balsam and adjust it on a piece of glass (Fig. 4.) The balsam is to keep it from floating about in moulding. Upon this pattern pour the following investment and cover with a second piece of glass:

Plaster of Paris	5	parts
Plumbago	3	"
Asbestos (grade 3)	6	"
Soapstone (pulv.)	1	"

Any other good heat resisting investment will do; the plumbago in this gives a fine surface to the casting. I recommend a careful application of the first drop of the investment, tapping glass from underneath to displace air.

Fig. 5 depicts mould with second glass in position. Try to keep these glasses about parallel, as it will be found convenient in casting to have mould fair.

On setting, slip off glasses laterally, or more correctly, in line with their planes. Any lifting of the glasses may bring away pattern, and this is undesirable at this stage, as the margins of mould would probably become damaged.

Place mould in case heater, or proceed, if hurried, directly to blowpipe. In any case the mould is finally placed on a flat surface. I have used the same half-brick for four years. If the surface is not flat, the mould may crack under pressure in casting. I prefer to remove pattern when soft, by pressing another and larger piece of softened composition on to it, allowing second piece to remain a moment, and then on removing it, the pattern comes away without defacing mould.

Pierce mould in all deep portions with a pointed wire or needle about 23 gauge and two inches long, being careful not to withdraw it, as this will pull back fibers of the asbestos, leaving a fur on the face of the mould, but grasp the point of wire as it projects from the back and continue its direction until it is free—in comparison as a tailor uses his needle.

Dry face of large hammer with blow-pipe. Ball up sufficient gold, same karat as band, to fill mould; this is a matter of judgment, and when quite fluid, press firmly and quickly down with warmed hammer.

If sufficient gold has not been used, or if the casting seems faulty, simply remelt and try again. On no account attempt to remove casting until you are satisfied that it is correct, as its removal often destroys the mould for another casting.

Casting is very simple to accomplish practically perfect, and the larger the pattern, the easier the casting.

Now you will find that the solid gold cusp piece will be a fac-simile of your composition pattern, and it is gratifying to see how neatly it fits your band. It is well to brush the flat side with the large file mentioned. This is best accomplished by driving casting, cusp side down into the end of a piece of wood, so that it becomes stationary for filing.

Often a long cusp will, in spite of your labors, almost if not quite show through your bite. Of course the casting shows the same defect.

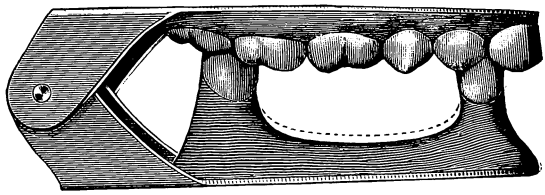


Fig. VI.

Simply reinforce this spot with a piece of plate by placing it in position after wiring together band and casting; pieces of solder judiciously placed unites all. If found necessary, grind out a portion of tooth to accommodate this extra piece.

A very good way to be certain of the exact position of your band and casting, is to make a slight but sharp V notch in convenient spot on your bite whilst trimming same on band, and a corresponding scratch is made exactly in line on the band.

Naturally the other pier crown receives the same treatment.

Place these crowns on their respective piers, and providing you have taken ordinary pains, you will find that the occlusion leaves nothing to be desired. Take a sufficient quantity of composition to fill in the space where teeth are missing, moulding it around the pier crowns for stability. Request patient to merely "close the mouth." Remove mass of composition and chill thoroughly in ice water. Trim away all traces of the bite only. Dry quickly with absorbent medium, and to this cut surface attach a quantity of quite soft composition (dry heat) sufficient to take

the bite. Slip this into position and procure the resultant bite of multiclusion, as in single crown work. Chill and remove after making a few marks to guide you in trimming the buccal surface. Carve this to the requisite number of teeth, three in this case. Keep it constantly chilled. Try in and ascertain if proper contour has been obtained. If correct, mark for "self cleansing" space, as shown by dotted lines in Fig. 6. Remove and bevel the inferior or gum surface linguo-buccally. Proceed with this pattern precisely as with single crown pattern.

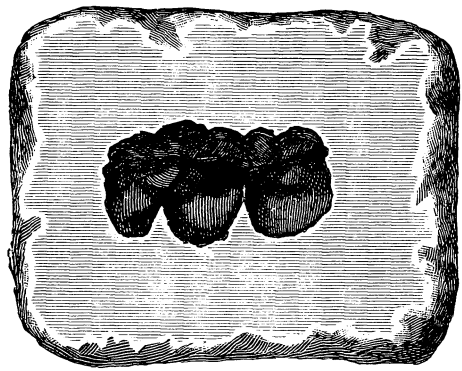


Fig. VII.

Fig. 7 shows mould in which casting was made for bridge being described. Air vents are distinctly portrayed. You will perceive that the three teeth are formed in one casting, and even four teeth only take about the same time as the occlusal cast piece of a single gold crown.

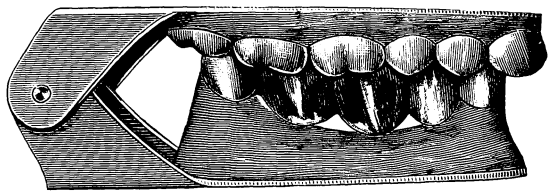


Fig. VIII.

File up approximal ends of large casting, so that no serious interference takes place with crowns to disturb occlusion. Solder with 14 karat, three cubical pieces of German silver, about 13 gauge, to the buccal surface of each gold crown and the intermediate dummy casting respectively. The reason for this will become obvious when you come to seat these parts in the impression to be described. Of course they will be re-

moved when polishing the bridge. A piece of half soft composition placed on the gum to support casting and keep it against the opposing teeth on closure, is the next step.

Instruct patient to keep maxillaries in close juxtaposition. With the finger or an appropriate instrument form a pocket along the buccal surface of the bridge by retracting the cheek laterally. Into this space, force quick-setting plaster. Remove plaster and bridge, rearrange parts in impression, and it is generally best to only solder one end first—the anterior usually.

Always bush or fill in neatly with gold, space between casting and crown, to keep the crown from moving over to casting on running of solder.

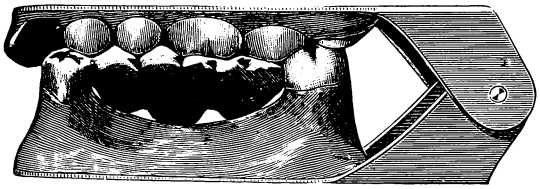


Fig. IX

Try in, and if all is correct and no movement takes place on opening the mouth, take impression of occlusal as well as buccal surface. Now remove and tack posterior crown at juncture with self-cleansing bevel.

To finish your soldering, a very convenient method is, to press bridge firmly into one of the used moulds, leaving exposed the part to be soldered. No movement will take place. I recommend thorough soldering, especially to solid cusp, occlusal castings of band crowns.

Many times you may wish to form a solid cusp piece for a band where there are no opposing teeth. Simply select a porcelain tooth to suit, and press it (it must be clean and dry), cusp end down, into an old mould, as deep as desired. Proceed as described. A full solid cast dummy may be made in the same manner.

Figs. 8 and 9 are different views of model bridge.

A Two-Part Flask for Forming Seamless Crowns.

By E. L. Townsend, D.D.S., Los Angeles, Cal

With this flask it is possible to form a mold in which can be fashioned an exact duplicate of a natural crown, or a cup for the purpose of holding a solid porcelain tooth after the well known system of Townsend, of bridge work. The ordinary flask is used, such as is used for forming all seamless crowns.

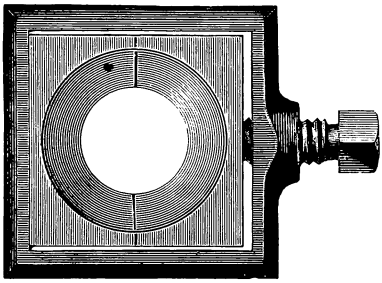


Fig.I

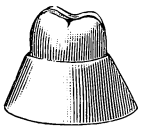


Fig.II

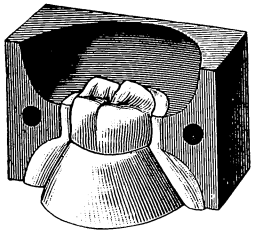


Fig.III

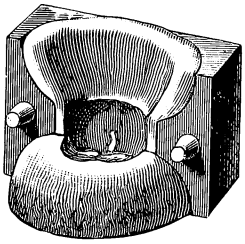


Fig IV

The blank is placed in the mold, and wet cotton is used for the purpose of expanding the blank to the contour of the mold. Oiled shot, modeling compound, marble dust or anything that will serve to expand the blank under pressure, can be used if preferred.

The flask serves a double purpose of affording a rapid method of making the mold, and of giving additional strength to protect the softer metal.

Fig. 1 shows the form of this flask together with its clamp.

Fig. 2 shows a plaster model of the tooth to be duplicated.

Fig. 3 shows Fig. 2 imbedded in one-half of the flask surrounded by moldine, leaving two-thirds of the crown exposed, viz., the occlusal surface, and one-half of the crown of the tooth.

The flask is brought together and fusible metal poured into the vacant part of the flask. This will give a mold of the shape shown in Fig. 4.

The moldine is removed and fusible metal poured into place and completes the mold.

This flask can be used for all forms of crowns, the anterior teeth being formed seamless or in two parts and soldered together. The method of forming the molds for the anterior teeth is practically the same as already described.

A Method of Crowning with Amalgam Roots of Multi-Rooted Teeth which have Become Separated by Decay.

By Dr. S. E. Fuller, Piqua, O.

Take for example a lower molar. First expose the ends of the roots by packing with gutta-percha for a few days; remove the decay, disinfect and fill the root canals.

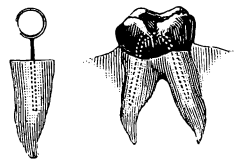


Fig. I Fig. II

If not already so, the axis of the roots may be made parallel by screwing into the roots a ring bolt* (Fig. 1), and drawing them together with ligatures or small rubber bands; or they may be separated by packing cotton between the rings.

When in position make two staples of round iridio-platinum wire, thread-cut, if desired; one to reach from the lingual canal of the mesial root to the distal canal, which should be broadened lingually to receive

* Suggested in Flagg's Plastics.

it. The other from the buccal canal to the distal canal, which should be broadened buccally to receive it. They should extend as deeply as the conditions will allow, and be as high as the articulation will permit.

Pack the space between the roots with stopping and place on a matrix to include both roots. Personally I prefer the Lennox, sold by Claudius Ash & Sons. Dry the ends of the roots and pack in amalgam solidly, using at first pellets as dry as can be made by the combined pressure of the thumb and forefinger of both hands, and complete with amalgam wrung out dry by means of the mercury expressor and chamois. Remove the matrix and carve the cusps as desired. After the amalgam has set, remove the crown and trim to the circumference of the roots, which will be plainly indicated if the amalgam has been properly packed. Cut out the amalgam from between the roots sufficiently to make a cleansing space and polish. Secure the crown to the roots with cement or gutta-percha as desired. Fig. 2 represents a completed crown.

All Gold Crowns.

By R. M. SANGER, D.D.S., East Orange, N. J.

To Dr. Paul Heller, of New York, I am indebted for the suggestions which led to the working out of the following system of making all gold crowns.

For the purpose of illustration, let us assume a bicuspid badly decayed. The missing tooth substance is restored with impression material and carved to the desired contour and occlusion. An impression is then taken of the tooth in plaster of Paris, poured and separated in the usual way, and we have a plaster model of the perfect tooth.

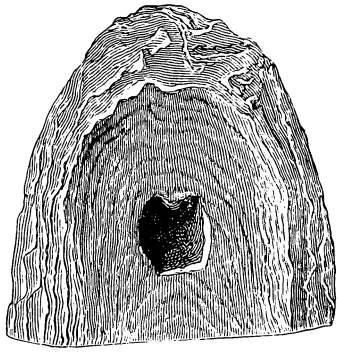
This is lengthened about one-sixteenth of an inch by cutting away the plaster at the cervix, and then the tooth is detached from the model and squared across the cervical end with a sharp pen-knife. It is then dipped in a solution of sandrach or some other good varnish to give it a good glaze and allowed to dry.

Taking Impression with Cuttle Fish.

Two pieces of cuttle fish of fine texture are selected, and the soft side rubbed smooth and flat on fine sand paper, and powdered soapstone is sprinkled over and gently rubbed into the surface of the cuttle fish to fill up the pores. The plaster tooth is then laid on its side in the center of one of the pieces of cuttle fish and pressed firmly down until it is imbedded to a little less than one-

half its thickness (see illustration); the other piece of cuttle fish is then laid upon it and pressed down until the two pieces of cuttle fish are firmly together. They are then separated, the model removed and we have a perfect impression of the tooth in two halves.

Rubber rings are placed on each of the halves to form matrices, and dies are poured with Mellotte's metal. Counterdies are made of the same metal, the die being coated with a solution of whiting and water



and dried, to prevent the counterdie sticking to it, and also to avoid a close fit, as the metal is not ductile and will split or crush when the gold is swedged, if no allowance is made for the thickness of the gold.

After the two halves are swedged, they are laid on the flat side of a metal file and rubbed until the flange is reduced to a feather edge. They are then placed together, smeared with borax, soldered and finished in the usual way, and we have a perfect fitting all gold crown.

A Composite Crown.

By James B. Hodgkin, D.D.S., Washington, D. C.

Molar crowns, other than gold dummies, are probably more difficult than almost any other in the mouth, and *lower* molar crowns more difficult, possibly, than upper.

The gold dummy, solid and serviceable as it may be, is simply hideous, if in full sight, and, as a rule, it is more in sight in the lower than in the upper jaw. I know of no all porcelain crown which is available, and so I adopted some time ago the following method which I have found fairly

serviceable in cases where there was room enough for any sort of a porcelain crown.

The remains of the natural crown being ground down fully to, or even a little below the gum line (Fig. 1 a), care being taken to follow fully any decay which may have progressed below the gum, the roots are prepared after such methods as may commend themselves to the operator, the special preparation being to get not only perfection of cleansing, but as much room as possible for the pins which are to hold the crown in place.

The natural shape these pins would take is, as a rule, flat or ovoid, and often in the front root the pin is quite flat and thin. It is well not to make the pin to entirely fill up the roots, as, in the case of divergence, they are hindered in passing in.

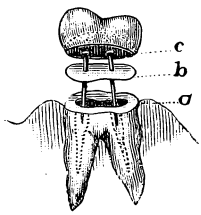


Fig. 1.

The choice of material for the pins is left to the operator, platinum being as good as any alloy, possibly better, as its softness does not injure its stability.

I usually fit the pins to the root canal before taking the next step, which is to cut a disk of platinum of about 30 gauge large enough to fully cover the ground down root. Holes are punched in this for the passage of the pins, and they and the disk are fitted to the root, care being taken to have the edges of the disk as perfectly coincident with the margins of the stump as possible. Unless this coincidence is secured, there is no end to the irritation that results, and I think that the method I suggest is more than usually useful, as allowing opportunity for this perfect adjustment, no crown being in the way to interfere.

The fitting done, an impression may now be taken and the pins soldered in place. For solder, I prefer pure gold, for the reason that vulcanite is to be used.

The ends of the pins *above* the disk are left projecting to a length about that of vulcanite pins in teeth. They should have some sort of head to them, to engage the vulcanite subsequently used, or a loop may be soldered on the face of the disk. (Fig. 1 b.)

The pins soldered in place, the affair is replaced in the roots, and an ordinary countersunk molar (Fig. 1 c), of suitable style, is so ground and adjusted as to make as good a joint as possible, although this is often impracticable if the root be much destroyed by decay. And, indeed, it is one of the merits of this crown that vulcanite fills up what may be lacking in shape in the root. The crown adjusted is waxed to the disk, articulated (and this latter can be tested *in situ*) and may be packed in any ordinary flask.

I have had better success in the vulcanite part of this crown, by using the light brown rubber of C. Ash & Sons, as it flows more readily than any other I have tried. As the joint is usually below the gum line, any line of vulcanite showing is out of sight.

After the vulcanizing and finishing, the crown may be secured in place with any cement selected, but I am strongly of the opinion that a very soft gutta percha makes the best setting for it. The pins can be warmed sufficiently to thoroughly set the crown in place without injury to the vulcanite joint. I have found it an advantage to place a pad on the occluding teeth and get the force of the jaw to crowd the crown home. The surplus gutta percha is easily gotten rid of by any of the well known means.

Crowns set in this way have the merit of simplicity of construction, of observation of the work at all stages of its progress, of almost perfection of fit against the root, and, what is to me no little matter, avoiding the glaring gold crown, than which nothing more barbarous can well be imagined so far as cosmetic effect is concerned. This crown has also the merit of easy removal, in case gutta percha is used for the union, and a further merit of not being "patented." It may be that there are other crowns than the "countersunk" which may be used, but of this I am not aware.

A Modified Davis Crown Setting.

By J. B. Hodgkin, D.D.S., Washington, D. C.

I have found difficulty in setting any of the crowns now made in the roots of the first bicuspid. The second bicuspid has usually fairly open roots, and often only one canal, but the first is often very puzzling on account of the bifurcations and other complications well understood and dreaded by those who undertake crown setting of any kind on these roots.

The Logan crown is well nigh useless in such work, as the pin must either be split, or else set in one root only.

My method with the Davis crown is to prepare the root canals as though for two separate pins. I then make two pins separately, fitting each as though it had no special relation to the other. A disk of thin platinum (about 34 or 36) is prepared, holes punched in this, the disk and pins fitted to place, and the pins soldered securely to the disk. Usually it will be found that the pins may be brought together, so as to make a projecting single pin on the crown side of the disk. Sometimes the pins may be manipulated by doubling the platinum or other wire on itself so as to form a staple, the part of the staple away from the points being brought in contact, and forming the pin which is to enter the hole in the crown.

The parts soldered, the pins and disk are placed in position, the edges trimmed, and the crown ground, fitted and articulated. The roots being filled with gutta percha, the pin with attached disk can be heated and forced into place, the crown tried on, and this last attached with cement.

The advantages are: The making of the pins to fit each root accurately; the ability to perfectly adjust the disk to the end of the root; the opportunity to see the work at every stage of its progress; the attachment of the pin to the root with a material which can be softened and removed at any time; and the opportunity to renew the crown in case of loss. If it be deemed desirable to band the root, this can be done, but it is, in many cases, not best. The advantage of not having a cement joint against the root is obvious.

The Counter-Sunk Nut.

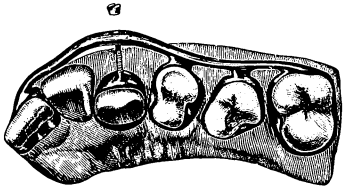
By WILLIAM W. SHRYOCK, Fort Wayne, Indiana.

I herewith present to the profession the use of the counter-sunk nut in Orthodontia. The illustration shows a case in which the left superior cuspid, closing inside the bite, was moved into position in thirty days, for a patient thirty years of age.

The figure shows the appliance in position, each band having been made in the mouth, then removed with the impression and filled, which placed the bands on the cast accurately. The bar was then made and soldered to the bands, a hole drilled through the bar with a No. 67 drill, and counter-bored to allow the nut to enter flush with face of the bar.

A bolt was then soldered to the band on the cuspid, with threads 140 to the inch, fitting No. 67 drill hole, and the nut turned on with the screw-driver. As the bolt came through the nut, by the movement of the cuspid, it was ground smooth.

The nuts are made by pouring the gold into a round ingot, and then drawing through draw-plate to No. 22, then placed in chuck on Mosely jewelers' lathe, tapered, cut off, threads cut, placed on mandril in slide rest and the slot cut. The appliance is made of 22 karat gold entirely, as gold is the best material that can be used in Orthodontia, and the counter-sunk nut the only one, there being no iritation to surrounding parts.



This appliance is the original one worn in the mouth, and simply gives an idea of what can be accomplished with the counter-sunk nut. This nut has been used in many different cases and there is no limit to its use, except in the ingenuity of the operator. In moving central incisors together, anterior teeth backward, one tooth out, the other in, or in turning a tooth, or in moving one tooth or a dozen, the effect is the same.

In pushing the nut is counter-sunk from the opposite side of the bar, and the appliance is on the outside of the teeth, under the lip or cheek, and nothing in the inside to interfere with the tongue in speech or mastication.

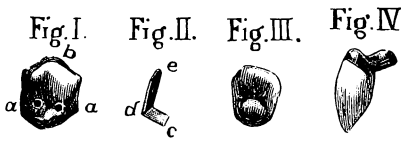
Making Gold Cusps and Backing for Porcelain Facings.

By Dr. H. B. Bull, Fairbury, Ill.

Having the abutments for the bridge on the model and in the articulator, place some wax between them to hold the facing, and grind for contact with the gum.

Bevel the facing from near the pins to the cutting edge (Fig. 1 aa to b), grinding off enough to make the facing the right length when the cusp is on. Take a piece of modeling compound, soften it, and press around the facing and abutments on the labial side; after it hardens, remove the wax, and the facings can be placed and replaced without changing their position.

Remove the facing and burnish pure gold, 32 gauge, to it for first backing, extending it a little over the cutting edge. Remove the backing, take a piece of 22 karat gold, 30 gauge, about the size of the first backing, bend it at an angle near the middle (Fig. 2 c. d. e.). Place the backings, back to back, in the tweezers, clasping them near the pin holes, so the angle of the second backing is opposite where the bevel commences on the first backing, and flow a little 20 karat solder, to hold them together at d; punch holes for the pins through the second backing and replace on the facing and articulator and holding first backing closely to the facing, bend the second backing d-e parallel with the cusps of the abutments; remove and flow 20 karat solder to fill up the depression at d, allowing some solder to flow on the first backing; replace on the facing and model.



Strike up the cusps and fill them with 20 karat solder, making it thicker in the center than at the labial and lingual edge.

Place it on the backing and try for position and articulation; it is not necessary for cusps and backing to be in contact all over, but the articulation should be left a little too long.

When in the right position catch with Parr's flux and remove from the facing; cover the back of the backing with rouge or whiting to keep solder from flowing there, then place in the tweezers for soldering.

I made tweezers for this work from wire tweezers with ring beaks; flatten one of the rings and straighten the other, then bend it at right angle to the opposite beak.

Place the backing in the flattened ring with the right angle point on the cusp. Using a good sized flame I burn off the wax, and when hot enough for the solder to flow, the pressure from the tweezers will make a perfect contact with cusps and backing.

Place on the facing, bend the pins to hold it and finish cusps on the labial side and the dummy is ready for investment.

The advantages of this method are ease of finish, less heat in final soldering, consequently less liability to fracture facings and a perfect articulation.

A Short and Accurate Way of Making a Gold Crown.

By Frederick Albert Roe, D.D.S., Burlington, Iowa.

Prepare the root according to the requirements of the case in hand. Fig. 1 is an upper right second molar which we will proceed to crown. So shape the remnant of tooth that a wire measurement taken beneath the free margin of the gum will slip off, and then, take a wire measure.

Fig. 1.

Fig. 2.

Fig. 3.

Make the band one-third longer than the finished crown will be. Festoon and fit it beneath the free margin of the gum. Remove the band. Place soft modeling compound on the top of the remnant of tooth and have patient bite into it. Chill the compound, and with a lancet or penknife carve such a tooth as you desire. Fig. 2 shows the tooth as formed.

Replace the band, being careful not to mar nor displace the compound. Then mix impression material rather thick and place in the open end of band, pressing it down upon and around the tooth. Fig. 3 shows the band in place with the impression material in the end. Use any impression material into which Melotte's fusible metal can be poured. Teague's impression compound is most excellent for this purpose. When set, remove band carefully, so as to avoid fracturing the impression. If the modeling compound remains in the band, warm and remove it.

Invert the band and insert the open end in a hole previously punched in a piece of rubber dam, allowing the dam to clutch the band about one-thirty-second of an inch below the edge all around. Suspend the band in a piece of inch rubber tubing (Melotte's ring) as shown in Fig. 4.

Coat the inside of the band and exposed edge with whiting and dry it. Pour Melotte's fusible metal into the band and allow the metal to cover the top of the ring. When cold, remove the dam and impression material.

We now have a metal tooth the exact length, perfect articulation, with the band upon it fitting snugly at the neck. The band is clutched in the metal at the base, preventing any possible change in after-manipulation. Remove the band.

Fig. 5 shows the metal tooth, which is exactly the form of tooth required, over which the crown is to be made. The form of the crown of the metal tooth may here be improved very easily with a bur in the engine, and the sides drawn in at the top, to suit the esthetics of the case in

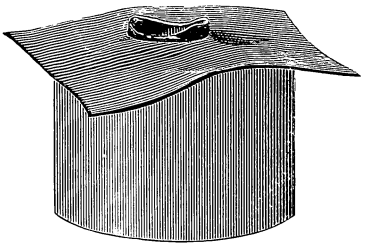


Fig. 4.

hand. Replace the band and trim it to the height of the cusps, clip it around the top, fold over, burnish it down and solder. Use a soft pine stick to define the buccal and lingual fissures. We now have a perfectly fitting band, nicely contoured.

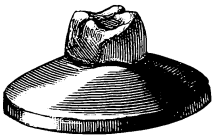


Fig. 5.

Fig. 6.

Now place a piece of cap material on the top of the metal tooth with the band in place, and strike it gently with a soft pine stick and light mallet. Remove, and tack cap to band with solder. Replace them and swedge as before. Solder and polish. Fig. 6 shows the completed crown.

This crown can be made and set in one hour, if you so desire, or the tooth can be prepared, band made, and impression taken and completed in laboratory.

In making abutments for bridges, this method is the same only no forming of the tooth in compound is required. Simply grind off the points

of contact, the thickness of the gold, take impression and proceed as before stated.

The crown may be reinforced as desired, and tooth cut down accordingly after the crown is completed, but this will not affect the perfect articulation.

The writer does not claim originality except in part.

Porcelain Faced Posterior Dummies.

By Dr. J. S. Bridges, Chicago, Ill.

A method of constructing porcelain faced dummies that has proved very satisfactory to me, is accomplished somewhat after the following procedure:

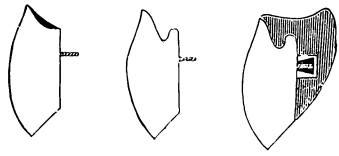


Fig. I. Fig. II. Fig. III.

The selected facing (preferably a thick one) is ground to articulate with the antagonizing tooth perfectly. Remove as much of the cutting edge of the porcelain as is desirable, but always grind the edge to a sharp line, as for the margin in cavity preparation.

Now bevel the facing as in Fig. 1. With a sharp knife edge carborundum stone, grind a slot across the entire length of the beveled surface, sloping nicely back from the occluding line. (Fig. 2.)

Replace the facing on the cast, and by carving cusps from plaster, and with dies of Mellotte's metal, swage a gold tip 32 gauge, trimming it to just reach the cutting line of the facing. Remove the carved plaster, and over the surface, from the pins to the cutting edge, burnish rolled gold foil 120 gauge, carrying well into the slot. Fit a piece of 28 gauge plate from the end of the bevel as close to the gingival line as will allow a clean convex surface when the dummy is completed. Bend the pins, wax the tip in place, allowing it to just reach and the foil to overlap the cutting edge a trifle. In soldering, use but little, if any, borax. Finish the occluding margin the same as for a filling, resulting in an infinitesimal line of gold along the cutting edge.

You now have a dummy with the facing showing practically no gold, and almost if not just as well protected as though the facing were cut squarely off, and the occluding surface capped with an unsightly tip of gold.

Removable Porcelain Facings.

If, as in an extremely long bridge, it is desirable to employ removable facings, the result may be accomplished much in the same manner.

When the facing is ready to receive the tip, do not bend the pins, but remove the porcelain, join the foil and plate with a bit of solder, replace the facing, and with a drop of hard wax, catch the tip in place without entangling the pins. Again remove the facing. Invest the tip and backing in plaster and silex. Before flowing in the solder to completely join the tip and backing, place over the pin holes a tray (with the sides slightly bent to the center) formed from thin gold or platinum, just deep enough to avoid the slight projection of the pins through the backing. Fill the tray with investing material to prevent the solder from flowing in.

With the reamers from Bryant's crown and bridge repair outfit, thread the pins of the facing preparatory to placing a small cone-shaped German silver tube. (Fig. 3*.) Screw the tubes on the pins, first having threaded the cones, leaving them just long enough to be grasped firmly by the cement with which the facing is set. Before replacing the facings, the holes in the backing must be enlarged to allow the passage of the reinforced pins.

Removable Porcelain Bridge Work.

By ADAM FLICKINGER, D.D.S., St. Louis, Mo.

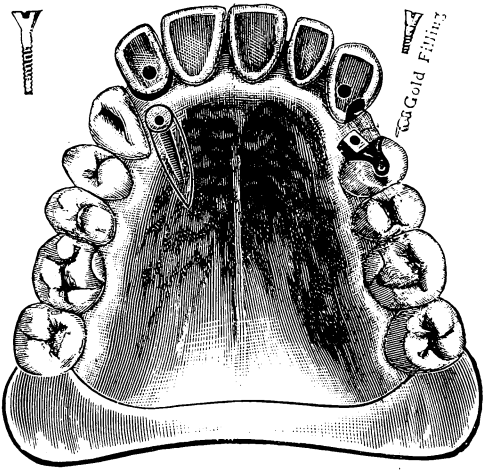
Dentistry, in this age of progress, has indisputably kept pace with the many other sciences, and its practitioners can now be classed with the scientific investigators who are exerting their best efforts for the attainments of higher standards.

If we look back and compare dentistry of the past with that of the present, we must admit the vast improvements in educational, preservative and the manipulative branches. Researches have given new light and have opened new fields for further investigations. Men are entering

* Fig. 3 is a cross section of the completed dummy. *a* indicates the space left by covering the pin holes with the metal tray. *b* is the threaded pin carrying the cone-shaped German silver tube.

the profession whose every opportunity for advancement is better than it was years ago, by virtue of greater educational facilities, and the use of more ingenious mechanical appliances; therefore, more satisfactory results can and must be expected.

Crown and bridge work has received no small share of attention, and various methods have been advanced by which, with some improvements in their minor details, the lost organs of mastication are best and most artistically substituted. That this class of work has been severely criticised in some of our dental societies and periodicals, and has been totally condemned by men who, through ignorant or injudicious application, failed in their attempts, is not surprising, for such work requires



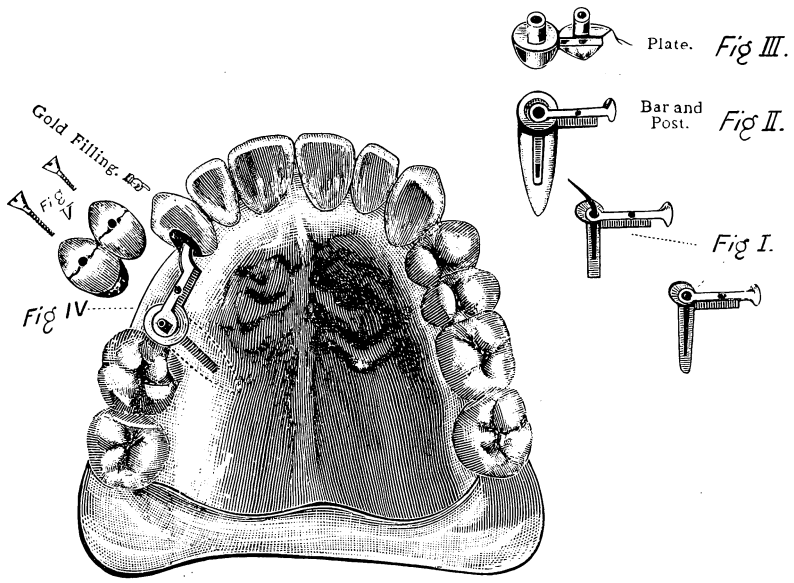
CASE I.

more than ordinary mechanical skill, and good judgment as to anchorages, abutments and other essential conditions. If, however, this work is made for the sole purpose of furnishing the people "teeth without plates," regardless of the condition of the mouth, or the roots, or teeth, it will probably prove a failure.

If gold shell crowns are placed conspicuously on the centrals, laterals or canines, to carry bridge work, it should be condemned as inartistic. If unscrupulous men who lack in the first principles of prosthetic dentistry, branch out as "bridge specialists," or if men who have devoted themselves entirely to "operating," as they term it, take up this work as a side issue to increase their incomes, success cannot be expected; for, usually, such men only prepare the abutments or anchorages, take an impression of the mouth and send the work to some mechanical dentist for finishing. Can one expect satisfactory results in such

cases? And need one wonder at the inartistic display of dentistry which confronts one at every step, on the street, at church, in fact, almost everywhere?

Porcelain crown and bridge work, like continuous gum work and porcelain fillings, offers the profession a large field for demonstrating true mechanical dental art, and also has a decided tendency to elevate prosthetic dentistry. Who of us is not filled with infinite pride and admiration at the sight of dental work, so cleverly wrought, as to conceal all artifice?



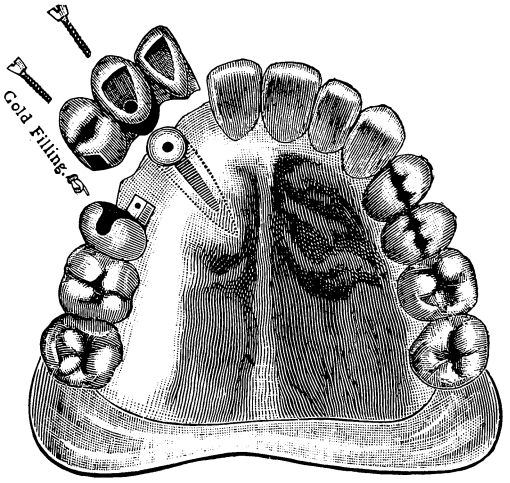
CASE 2.

For years I have advocated and followed a system of removable porcelain crown and bridge work with most gratifying success. The first case, Case 1, constructed on this principle, was a rather long span of five superior anterior teeth with only one abutment. The bridge was anchored in the first left bicuspid by a stub bar retained by a gold filling; on the other side, the bridge was attached to a feruled post in the right lateral root by a screw.

Case 2 shows model with first and second bicuspids missing. The first bicuspid had to be extracted; the second bicuspid root was in good condition; the canine was slightly decayed. This cavity was prepared to retain the bar, and the second bicuspid root for the feruled post with bar attachment. The post and bar were made of iridio-platinum,

and so arranged that the bar stretched across the first bicuspid space, and entered the canine cavity as shown in the illustration.

The rubber dam was placed over the centrals, lateral and canine, and allowed to extend to the second bicuspid root; the united post and bar (Fig. 1) was cemented into place (Fig. 4), and the gold filling in the canine, retaining the bar, completed. An impression was taken with modeling compound, and the saddle (Fig. 3) of heavy iridio-platinum plate was swedged to fit snugly over the bar and post (Fig. 2). Long cross pin teeth were selected, ground and soldered to the upright cylindric posts as shown in Case 3; the palatine cusps were then baked on to complete the bicuspids, leaving the openings in the centers for the screws, as shown in Case 2 (Fig. 5).



CASE 3.

Case 3 illustrates first and second bicuspids. The first bicuspid root was considered not strong enough to carry its crown, hence the two crowns were united in the form of a bridge, which gave additional security.

These cases have stood the test six years, and promise to last at least as many more.

When all conditions in the mouth are favorable, and due attention is paid to the stability of anchorage, abutments, and the occlusion is duly considered, I see no reason why porcelain crown or bridge work should not take the place of plate work. If, in addition to beauty, such bridge work permits ready removal from time to time for examination, and is easily repaired in case of breakage, it does strongly recommend itself.

How to Make Backing for Porcelain Facings.

By Dr. Arthur S. Cooper, Baltimore, Md.

Long and often have I rubbed my sore fingers, and have seen others do the same thing, after the process of backing up facings for crown and bridge work, especially after the tipping part of the process. Having arrived at an easier and more satisfactory method, those who advocate tipping facings, and more especially those who desire the backing to *fit*, may be interested in the following, the materials needed for the work being a moldine outfit:

First. Grind facing to proper size and shape.

Second. Cut backing a little too large all around; punch holes in backing for pins; cut pins off about proper length.

Third. Take rather deep impression of back of facing in moldine composition. In removing facing with pointed instrument be careful to repair damage to impression caused by instrument. Cut common toilet pins into halves or quarters and insert two of the pieces in holes made in impression by pins of facing.

Fourth. Place rubber ring around impression of backing and take cast of same. This will give a reproduction of back of facing, with long pins.

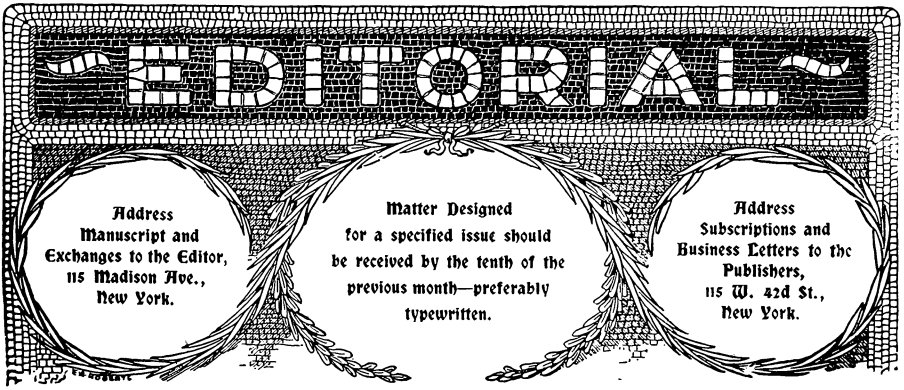
Fifth. Place backing on cast and trim pins short; shape backing slightly with fingers; remove backing and place small piece of wax between pin holes on under side and replace backing on cast—the wax will hold backing in place when cast is turned over.

Sixth. With piece of lead for counter die, proceed to stamp out a backing that will *fit* the facing.

Make a joint in a Richmond crown between gold and porcelain above, with little or no burnishing.

Make a tip on incisive edge that will require very little more work to complete.

In speaking of tipping facings, we have the teachings of those to consider who say that tipping facings increases their liability to crack; and others who have learned by experience that facings are not safe untipped. As the work of tipping facings is made easier and more accurate, I think the objections of the former will decrease accordingly.



Prosthodontia.

"What's in a name? A rose by any other name would smell as sweet," is often quoted with the claim that Shakespeare thought one name as good as another. But the Bard made no such error. The words, though penned by the immortal poet, issue from the mouth of an immature maiden in her teens, who scarcely should be expected to talk in sound philosophy.

Quite another view was expressed by the old darky, when asked why so many of his race become members of lodges, secret societies, and the like. His answer teems with philosophic truth. He said:

"My frien', ef a nigger don't jine no lodge he ain't nothin' but a plain nigger! Ef he do jine a lodge he stan' a chance to git to be a Pas' Gran' somethin' or other."

There is little doubt that the respect which we command and the dignity which we assume is often supported by our titles. The M.D. may count himself a little higher than the D.D.S., but the latter as a member of a profession, certainly feels above the mere man of commerce. Again, the president of a corporation looks down upon his employees, who in turn consider themselves immeasurably higher than the tramp, since labor dignifies. Yet our glorious Constitution declares that all men are equal. So it is all in the name.

The general truth is specifically applicable to our professional work. Dentistry was surely born of a mechanic mother, with an artist for the

father. We have always chosen to ignore this mother and even in the earliest periods we reckoned Dentistry as one of the Arts. Now we look higher and call it one of the Learned Professions, of which heretofore there were but three. As we have drifted away from our parentage, we have ever resented names attributed to us which remind us that we are mechanics. Nothing exasperates us more than to hear others call us "tooth carpenters." Long ago we discarded the words "Mechanical Dentistry," substituting the more high sounding phrase "Prosthetic Dentistry." Certain of us dislike the mechanic side of our calling so much that they have devoted themselves exclusively to "Operative Dentistry" and would almost feel demeaned if it were thought that their "mechanical work" were done with their own hands. These wish it distinctly understood that that branch of their labors is relegated to the "hired man in the laboratory." These men have at last grown so dignified and self respecting that nowadays they call themselves "Stomatologists."

Why this feeling against mechanics? It requires a great deal of brain to know what is mechanical, and a great deal of skill to apply the knowledge so that the result will be the highest mechanical achievement. Moreover, in spite of all the antipathy and disdain which is felt towards the mechanical side of our profession, it is exactly that side which has made the greatest progress during the past quarter of a century.

It is noteworthy that the only specialty in dentistry which is universally recognized under a special name, Orthodontia, is really more mechanical than operative, to return momentarily to the old terms. Yet the specialist in Orthodontia is rightly proud of his success in his chosen work, and would be quite astonished to be told that he were less important than the Stomatologist.

Since there is so much in a name, and since after all, mechanics is the foundation rock upon which must rest the glorious palace of dentistry, may it not be possible to rid ourselves of the prejudice against "mechanical dentistry" by adopting for it a title which would bestow upon it that dignity which some seem to think it lacks?

It is with this object that this special number of ITEMS OF INTEREST has been made up, and in offering it to the profession we venture to suggest that hereafter we allude to mechanical dentistry as Prosthodontia, the derivation of which is analogous to Orthodontia.